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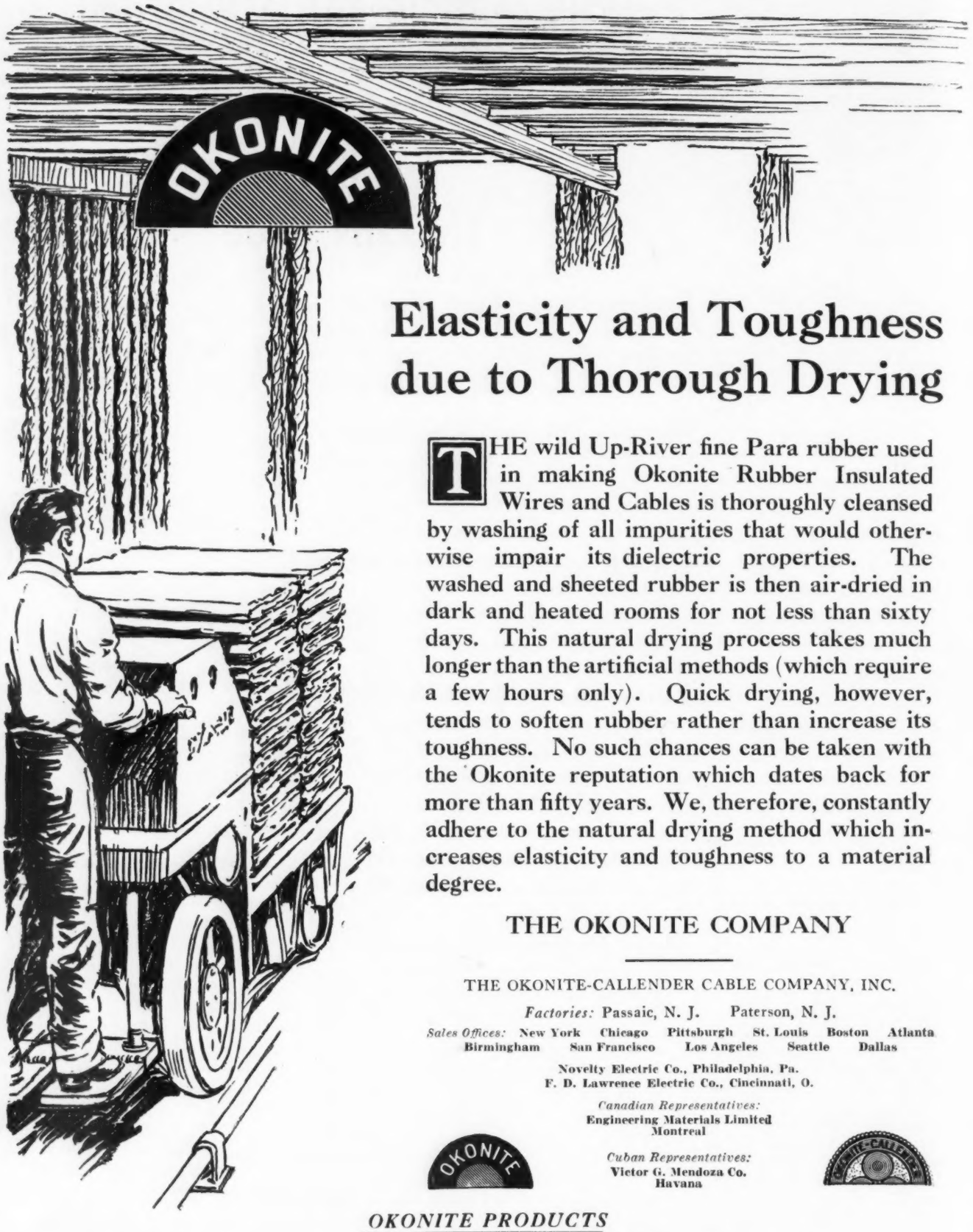
Data on Large Systems

A FEW copies are available of the Supplement to the ELECTRICAL WORLD of May 5, 1928, and may be obtained, until the supply is exhausted, by addressing the Statistical Editor. This Supplement, printed on a sheet 25x30 in., gives detailed data on the rating, output and allocation of energy of 155 large utility systems.



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Probable Effect of Metal Market on Electrical Equipment

THE steadily rising price of copper, the present price of 19½ cents being the highest since 1919, indicates that before long advances may be expected in the price of electrical machinery and equipment of all kinds. Already brass products and nickel silver have swung upward in price about half a cent a pound, and there is a perceptible shortage of the refined red metal which may cause it to rise still further. Similar conditions prevail in the lead market owing to trouble in Mexico, so that lead-covered cable now selling at what the manufacturers claim to be a non-profitable basis will in all likelihood also advance. Electrical steel is also exhibiting an upward tendency.

Copper ore there is in plenty, but the refineries cannot keep up with the present demand for finished material. So long as the electrical industry continues to grow, so long will more and more copper be required. The electrical industry uses more than 40 per cent of the available copper, and the automotive industry uses about 12 per cent. Both these industries are forging ahead rapidly; hence the drain on the available supply. Moreover, many manufacturers find themselves in an underbought position, and this, coupled with increasing demands for export, would indicate a stiffer spot market for the next few months. Unfortunately, in periods of shortage there is generally a wild and needless scramble to buy up what there is, with the inevitable result that prices go skyrocketing. If this tendency can be kept in check, we shall not have a runaway copper market, and the prices of electrical apparatus will not soar inordinately.

* * * *

Research Must Stand the Test of Unaccelerated Experience

RESEARCH workers rely upon both purely scientific and empirical methods to gain accurate impressions of related phenomena, but recognize that neither abstractions nor experiments can singly point the way to any considerable amount of knowledge of processes, materials or natural laws. One of the greatest contributors to our age of mechanical and electrical progress has adopted largely cut-and-try methods to achieve his purposes, yet he must fall back upon the symbols, formulas and concepts of the abstruse to complete his work just as the most carefully planned study of transient phenomena must stand the test of field analyses and observations if the results are to be worth anything. But there is a middle ground of research that is neither one thing nor the other, and it is in this class of work that the subtle errors of too confident assumptions sometimes creep in to confound the observer and student.

Small-scale models and other laboratory expedients for the more facile determination of large-scale phenomena are firmly established and have done well-nigh heroic service, but laboratory approximations cannot exactly reproduce all elements nor always allow for time factors, and the unknown sources of error, or even the known ones, sometimes lead to absurdities or again to less patent errors which may remain undetected for long periods and eventually require the redoing of much work which should have been accomplished once and for all.

Research is established so strongly and is becoming so warmly welcomed for its manifest merits that it would be a pity if in some respects it failed to meet the test of time. Nothing is certain until all the facts are established and the full time element is included. The captious philosopher will tell you that such a thing cannot be done this side of paradise, but, allowing for the truly unknowable, there is still the proving ground of actual use to which all theories, guesses and assumptions must ultimately yield. Such information as we assume to be knowledge should be put to the ultimate test of meeting all the conditions of nature and ignoring none of the inconvenient ones.

* * * *

A Notable Engineering Achievement

FROM the inception of high-pressure steam-plant operation by the Edison Electric Illuminating Company of Boston barely three years ago interest has been keen as to the success of this pioneer development. The use of 1,200-lb. steam boilers, pumps and turbines at Edgar station has passed from the experimental to the developmental stage; the employment of 1,600-lb. steam boiler and pump equipment is giving excellent results and the operating economies of the outfit are meeting the demands of the designers and their client. With partial high-pressure equipment Edgar station is delivering a kilowatt-hour on close to one pound of first-class bituminous coal, and the prospect of increased efficiency from the further use of high-presure units and of higher temperatures almost within reach through advanced metallurgical research is very alluring.

The first of two articles to appear in the ELECTRICAL WORLD in connection with the operating experiences and engineering design lessons derived from performance data for this station appears in this issue. These articles are based on papers recently presented before the Metropolitan Section of the A.S.M.E. In one of these papers I. E. Moultrop covered the influence of direct experience upon the design and development of the plant. R. E.

Dillon told with admirable frankness of the operating problems which have marked the work and their solutions. Although a good many difficulties have arisen, it is a fair statement that these have apparently been overcome sufficiently by manufacturers and operators to put high-pressure practice on an every-day plane. Nothing short of a triumph in boiler design has been attained in the evolution of these few years, particularly in connection with relative heating surface and capacity.

Brilliant work has been done in the development and application of feed pumping and other auxiliary apparatus to meet the present requirements. As for the 1,200-lb. turbines, in both availability and performance the record has been superb. The Boston Edison Company is firmly convinced that the economic problem connected with high-pressure steam has been solved by its experience, and it is to be hoped that in the near future a complete cost analysis of this courageous development will be available to satisfy the industry's natural desire for a full dollars-and-cents accounting and evaluation of advantages.

* * * *

The Stage "Takes up Science in a Serious Way"

EVERY ONE knows what a mess the daily press often makes of scientific subjects—how ridiculous the average reporter's write-up of scientific and engineering achievements generally appears to the reader who is versed in such subjects. Now comes the stage to prove that there, too, when science becomes the Deus ex machina the god is one unknown to the technician in the audience. "Wings Over Europe" deals with split atoms. Some one suddenly discovers how to split atoms, and he has a sufficient amount of split atomic energy stored in a watch to blow up the earth. The desperate author has to resort to murder and shoots the poor inventor in order to save our planet. Now, in spite of professors who relish sensations, the engineering profession can never become very enthusiastic about the prospect of releasing a sufficient amount of atomic energy to operate powerful machines, and the playwright came out with his split atoms at a time when Millikan and others have succeeded in definitely disposing of the split-atom Utopia and in proving conclusively that it will never be possible to release more atomic energy than would be required to operate two or three peanut stands.

Another drama of the sort is "Dynamo." One can readily conceive of an operator exaggerating his own importance because he can control the enormous energy of a hydro-electric or steam unit, or even on a dreamy night, when watching a machine, imagining it to be a living being, which can be healthy or sick, run up a temperature or even be moody, and over which he is master, being able to give it life or death. In fact, anybody who ever sat through a twenty-four-hour heat run will recollect having had such dreams. But this playwright reverses the process. His operator is so demented as to consider the machine his superior, his god. The method used by the operator to commit suicide is as sensible as jumping off Brooklyn Bridge and slashing one's wrist on the way down to make sure. He climbs to the top of a large hydro-electric unit in a rather old-fashioned power house, touches something and falls off. There is nothing more dangerous at the top of a large hydro-electric unit to touch than perhaps some exciter terminal. Any operator bent on suicide would know that he could get much better results by simply walking over to a high-voltage switch and grabbing a terminal.

But in all fairness, literally minded engineers should recognize that the artist or playwright is little concerned with technical details, for these are but cobwebs on which to hang the fabric of dreams. It is the idea that counts, not the mechanism. If in "Dynamo" the operator is unbelievably wrong technically, he may—and no one is to judge but O'Neill—be everlastingly right as a sensitive madman. Artists could well follow true science with more fidelity, but engineers should be tolerant of the dreamer.

* * * *

Wood or Steel for 220-Kv. Lines?

RECENT interest in 220-kv. line construction has led many engineers to a consideration of the relative merits of wooden-pole and steel-tower supports. Much can be said for each, but the California companies that pioneered in 220-kv. transmission are strongly in favor of steel towers.

If it were feasible to take advantage of the insulating properties of wooden poles and cross-arms on a 220-kv. line, the possibility of flashovers might be reduced, but unfortunately, these companies maintain, it cannot be done, since it is imperative to bond and ground all hardware to prevent pole-top fires. Not alone is the problem one of mechanical reliability and prevention of pole fires, but a greater number of insulators are required with wooden structures because of the shorter spans and the consequent greater frequency of supports necessary and because of the more frequent dead-ending that is also requisite. The additional insulators might easily run up the total cost to such an extent that the difference as compared with a steel-tower line would not warrant the use of wooden poles.

There are engineers who hold that the performance of wooden-pole transmission lines is superior to that of steel-tower lines, particularly as regards flashovers and lightning, but since there is only one short section of 220-kv. wooden-pole line in operation at the present time, there is little or no experience to bear out this theory. Conductors for 220-kv. lines must be of large diameter and of necessity are heavy, and this fact introduces the problem of mechanical reliability. Economy dictates that 220-kv. lines shall carry large amounts of power, and this again requires high reliability.

On lower-voltage and smaller-capacity lines wooden poles have many advantages, but for 220-kv. transmission a case has not yet been made.

* * * *

When the Stream Runs Low

THE public fallacy of assuming that water-power development can be considered by itself, independently of associated plants generating electrical energy from fuel, is illustrated by conditions that arose during the last few months of 1928. As is well known, the central-station load increases during the fall months, rising to an annual maximum in December. In 1927 there was enough water to care for the entire increase from October to December, with very little change in the output from fuel. In 1928 there was a falling off during those months, so that fuel had to carry not only the normal increase but also a decreased stream-flow excess.

A particularly notable case is that of California, where the output from fuel was 40 per cent greater in December than in November. The output from water fell off about 42,000,000 kw.-hr. This and the normal additional requirements called for 48,000,000 kw.-hr. that had to come from the plants burning gas and oil. Fuel consumption increased 42 per cent.

As a matter of conservation, our water-power resources should be developed to the economic maximum. But in computing the cost the public usually forgets that adequate steam reserve constitutes an essential part of the system. The economics must be worked out on that basis if the conclusion is to be sound. Without such reserve, where would California's users of electricity have been? What would be the situation in New England or other industrial sections if consumers had to depend exclusively on water, even supposing there were enough, which is not the case?

In great-grandfather's day he didn't have to run the old grist mill when the brook was low. But we cannot afford to halt commercial and industrial activity in California, Massachusetts or New York because of low water.

* * * *

Public Acceptance of Lighting Service

MODERN art in lighting was the subject of a recent meeting in New York of the Illuminating Engineering Society, when a number of papers and many illustrations were presented showing almost a phenomenal development in this field in a very short time. There was even a paper on the history of this development, still in its infancy as it is.

But the room in the Engineering Societies Building in which the meeting was held showed rather atrocious lighting conditions, and many whispered comments were made on the extreme ugliness of the illumination on the ceiling. This is not an isolated case of the cobbler's children going barefoot. Such a thing is quite common among the cobblers in the electrical industry. Public utilities with lighting specialists on their staffs show in many cases most incompetent lighting designs in their offices, display rooms, power houses, substations and storehouses. Obviously, they did not consult their own specialists, but allowed the architect to indicate the usual little circles on a plan, call it a lighting layout, and let it go at that. On the other hand, architects are not prone to take advice on lighting, because such advice is generally furnished gratis by public utility companies, lamp manufacturers, fixture manufacturers and even electrical contractors. They have a prejudice against the use of free advice—no matter how competent it may be.

The availability of so much free advice makes the existence of an independent profession of consultants on illumination impossible. There is no more reason for the public to accept advice on illumination from a lamp or fixture manufacturer than there is for a sick man to accept a prescription from a drug manufacturer. There is no more reason for a customer to accept free advice on illumination from a public utility than there is for him to accept free legal advice from the police or the district attorney. It must not be forgotten, however, that the remarkable development of illumination in this country has been the result of the use of this free advice, and experience shows that, on the whole, it has been competent, unbiased and the best available in an art that is changing rapidly and that has not had public acceptance to the degree needed for the support of independent illumination consultants.

Until the public accepts the idea that illumination is an art and a science that can render service in the degree in which service is desired, inartistic, inefficient and obsolete lighting installations will exist. To bring such acceptance is the task before both those who give free advice on lighting and those who try to make a living as illumination consultants.

* * * *

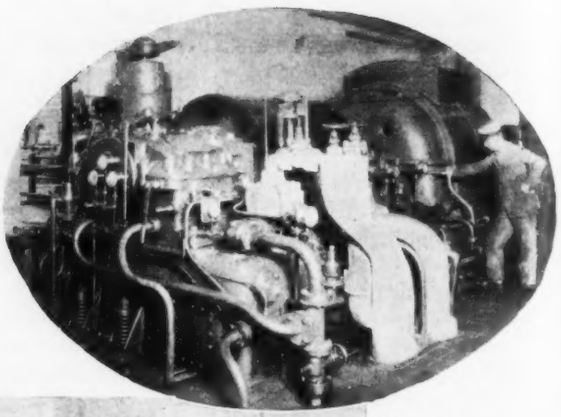
Arc Welding Influences Machine Design

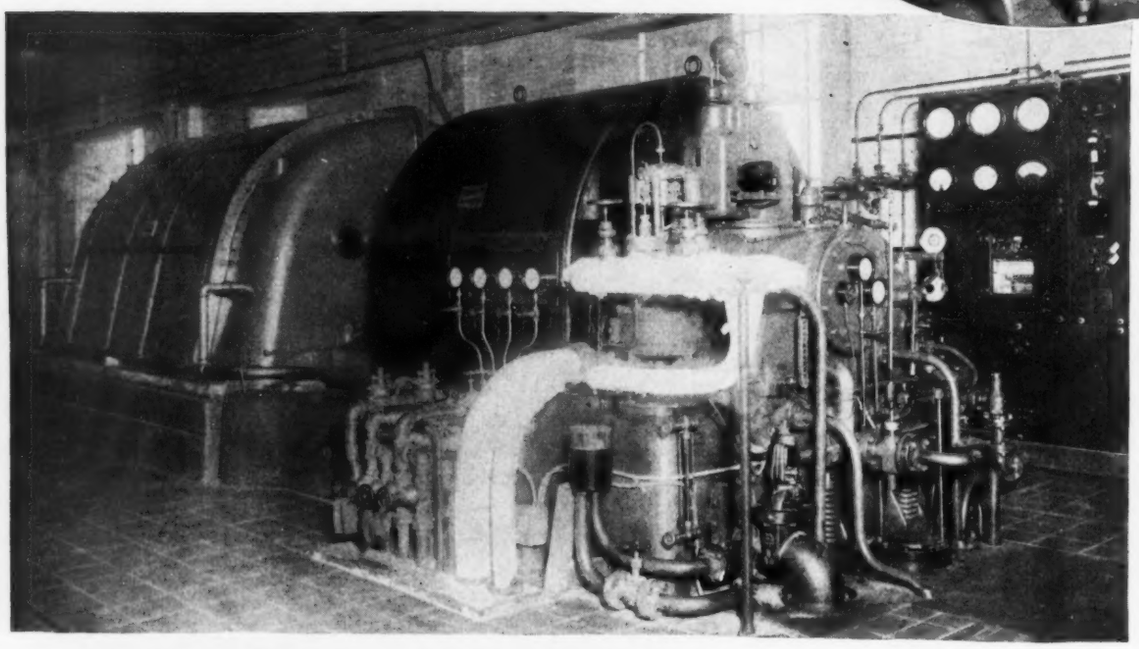
PROGRESS in arc welding is rapidly approaching a point where it may be regarded as a major influence in machine design. All new methods in engineering are exposed to the dangers of overenthusiasm, but if the field of improved processes is properly analyzed from time to time and sweeping conclusions from premature data are avoided, advances in practice are sure to be steady and ground gained will seldom be lost. Thus at the recent industrial electric heating conference in New England J. F. Lincoln pointed out that the application of arc welding to manufacture is not only the utilization of a new production tool, but it is also the development of a new and fundamental manufacturing process and should be so approached.

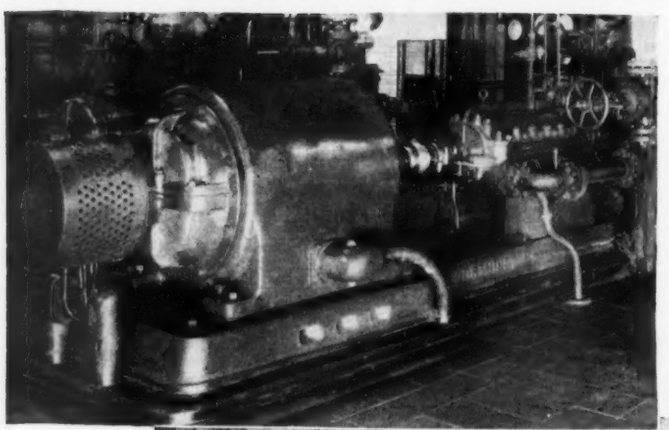
Until new tools and new standards were made available high-speed steel was of comparatively small importance. Alloy steel was of little value until designs were modified to take advantage of its greater efficiency. Similarly, if arc-welded steel is to be used in its proper sphere, old conceptions of designing must be revised. This applies to structural work of many kinds, and it is particularly desirable to avoid the limitations forced upon old methods by various changes due to processing when undertaking the design of structures to be arc-welded. Many structural designs represent changes brought about by difficulties in insuring adequate strength in castings after shrinkage or in obtaining proper shape in view of molding limitations. Warping of castings during machining may also affect the ultimate design. For such reasons the designer of an arc-welded machine base should make a fresh start, apportioning his material according to the selected loads and deflections and getting the benefit of the accurate work associated with this method. For example, where an arc-welded steel base is made of the same depth as a cast-iron structure, all sections may be 40 per cent as heavy without sacrifice of stiffness; in the design of containers the difference between welded and riveted joint strength will often cut down the amount of material needed by 20 to 50 per cent, and sections may be reinforced.

Errors in designing for arc-welded structures are usually due to delays in getting started, to hasty efforts without proper design, equipment and training, absence of engineering analysis and supervision, hesitation when a new design properly engineered first comes through because of its lightness of weight and "spindly" appearance, and fixed ideas as to the low cost of operating one's own foundry. The importance of training men to supervise practice properly is vital in the present stage of the art, and as large electric welding jobs multiply the ubiquitous machine designer will be able to draw upon the experience of others to a greater degree.

High-Pressure Steam Development Continues in Boston

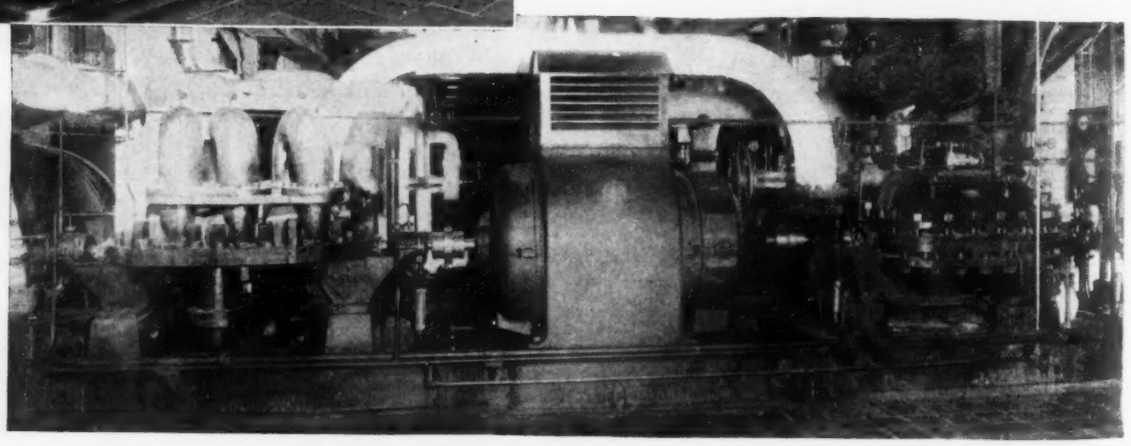






The most recent 1,200-lb. turbo-generator at Edgar station is of 10,000-kw. rating. The first (oval) was rated at 3,150 kw.

The 1,600-lb. boiler feed pump used by the Edison Electric Illuminating Company of Boston bears little resemblance to the 1,200-lb. equipment (left) of 1925.



Lessons from Edgar Station*

Effect of operating experience at high pressures on plant development. Success of pioneer equipment spurs designing engineers to intensive achievement

By I. E. MOULTROP
Chief Engineer
Edison Electric Illuminating Company of Boston

A daring step into the engineering unknown was taken by the Boston Edison company in 1925 when the first commercial 1,200-lb. steam turbine and boiler installation went into operation at the new Edgar station. The resulting fuel economies are well known to engineers, but the influence of the experience gained upon the subsequent development of the plant design is new material. In this issue Mr. Moultrop's recent A.S.M.E. paper bringing this development up to date has been condensed to give the ELECTRICAL WORLD *reader a sharply focused picture of the engineering thinking behind the recent extensions of Edgar station, based as these are upon the conviction of himself and his associates that high-pressure steam has come to stay; that it has passed from the experimental to the developmental period, and that its economic aspects are satisfactory, given proper designing skill.*

STEAM pressure in the plants of the Boston Edison company has increased since 1887 from 90 to 1,400 lb. per square inch. Our studies, indicating that there is no commercial economy in going to pressures much above 1,500 lb., may not be conclusive in the light of further experience in Europe and America. Only a few months ago a company in the United States contracted for equipment to operate at 1,800 lb. The results obtained by this installation will be watched with interest. While we in America have hesitated to go beyond 750 or 775 deg. F., European engineers are operating equipment utilizing steam at 840 deg. F. If the past is any indication of the future, we will be using 1,000 deg. steam before we realize it.

We are still looking for satisfactory and reasonable priced materials which will allow us to use steam temperatures of 1,000 deg. and above. A vast amount of research work has been done along this line and we are confident that a suitable alloy will be developed in the near future.

The studies made by the Boston Edison company indicated that it is not economical to use pressures higher than 350 or 400 lb. unless the steam is reheated during its expansion from throttle to condenser pressure. If reheat is employed large improvements in commercial economy are to be obtained by raising the operating pressure to as high as 1,200 or 1,500 lb.

Our expectations as to the improvement in economy at 1,200 lb. have been realized and, furthermore, we have found that the additional expense of the high-pressure equipment is justified by its greater power-generating capacity. If the design is correct, a high-pressure station need not cost any more per unit of generating capacity than one designed for lower pressures. Mistakes in the design of high-pressure stations are very costly.

The question of whether the use of higher pressures is justified in view of expected higher cost of construction has been raised every time pressures have been increased. We believe that many do not realize that we are not interested so much in the cost of a particular part of a station as we are in the cost per kilowatt of generating capacity of the completed station. We are willing to pay more for a few parts if these few parts will reduce the cost per kilowatt of the completed installation.

Fig. 1 shows an approximate split-up of the costs of the various parts of a steam-electric generating station. The switchgear, switch house and auxiliary equipment cost approximately 22 per cent of the whole. These parts will cost approximately the same per kilowatt of capacity irrespective of the operating steam pressure. The turbo-generators and their foundations cost slightly more per kilowatt for high-pressure equipment, but they account for only 16 per cent of the total and the increase in cost is small. We have reason to believe that in the very near future the cost of high-pressure turbo-generators will not exceed the cost of normal pressure equipment.

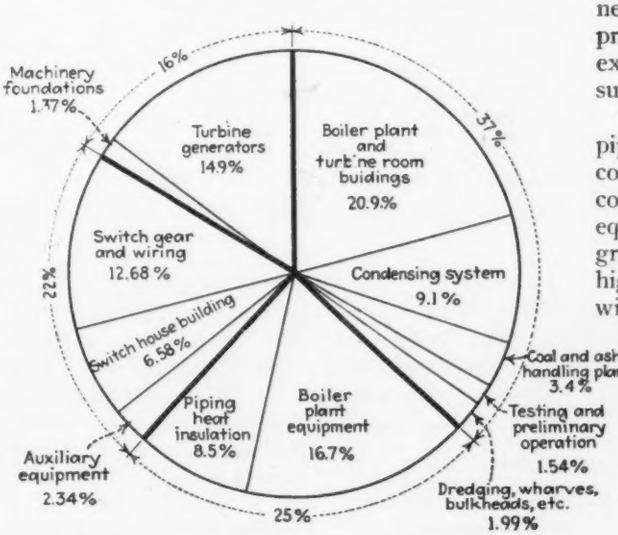


Fig. 1—Proportional costs of steam-electric station components

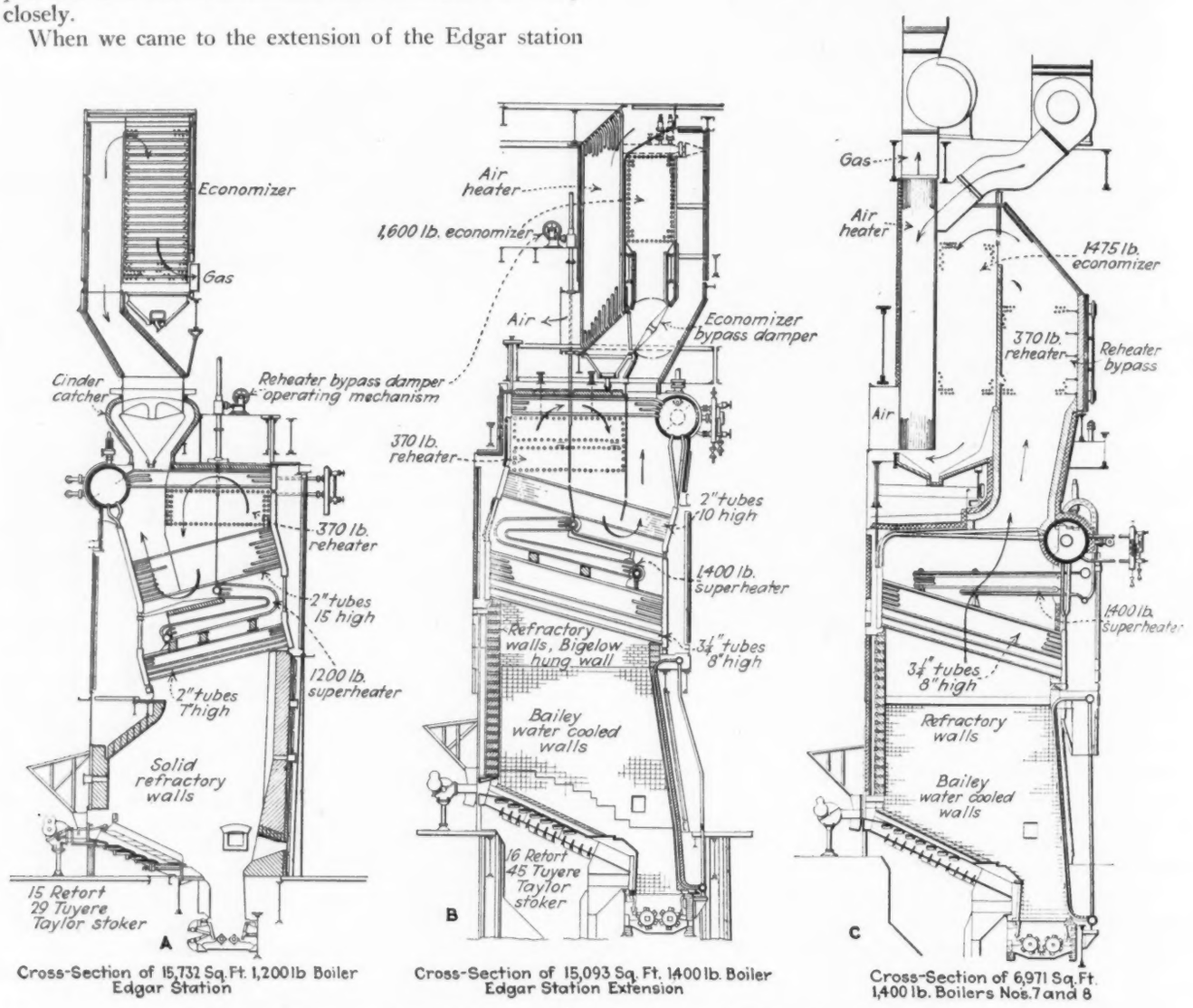
The boiler plant equipment, piping and heat insulation, which constitute 25 per cent of the total, cost more for high-pressure equipment, but because of the greater kilowatt capacity of a high-pressure boiler as compared with a low-pressure boiler of the same size the increase is not as great as one might expect. Boiler plant equipment, such as fuel-burning apparatus, fans, ducts, breechings, cinder catchers, etc., costs less per unit of generating capacity and helps balance the higher cost of the pressure parts.

**From a paper recently presented before the Metropolitan Section of the A.S.M.E. at New York City.*

Last, but not least, approximately 37 per cent of the total cost of a station covers boiler plant and turbine room buildings, the condensing system including intake and discharge tunnels and coal and ash-handling equipment. All these items cost materially less in a high-pressure station than in a normal-pressure station. From this it is not so surprising that we can build a high-pressure station for approximately the same cost as we can build a normal-pressure station. A number of other companies have made independent studies of the same problem and their conclusions have checked ours very closely.

When we came to the extension of the Edgar station into a period of intensive development. The high-pressure boilers and turbines now being built are of large capacity. Three-spindle, cross-compound, 1,200-lb. turbines of 85,000 kw. capacity have already been built; 1,400-lb. boilers capable of carrying a load of 25,000 kw. are in service and larger ones are now being erected.

Turbo-generators in service and on order utilizing steam at 1,200 lb. and above have an aggregate capacity of over 200,000 kw. If one adds to this the capacity of the normal-pressure turbines that receive steam from the



Cross-Section of 15,732 Sq. Ft. 1,200 lb Boiler Edgar Station

Cross-Section of 15,093 Sq. Ft. 1400 lb. Boiler Edgar Station Extension

Cross-Section of 6,971 Sq. Ft. 1,400 lb. Boilers Nos. 7 and 8

Fig. 2—Progressive high-pressure designs. Boiler C has 54 per cent of the heating surface and double the capacity of boiler A

we reviewed the question of the most economical pressure in the light of our operating and construction experience with the 1,200-lb. equipment, and on the basis of this study we have installed equipment designed for 1,400 lb. We are confident that higher pressures up to 1,400 lb. are economically justified.

High Pressures No Longer Experimental

Because of the discussions that have been going on as to the economics of high pressures as compared with normal pressures, some may not realize that high-pressure equipment has already passed from the experimental stage exhausts of some of the high-pressure machines in the above figure the aggregate capacity totals about 325,000 kw. The boilers supplying steam to these turbines have a total heating surface of approximately 170,000 sq.ft. The turbo-generators in service and on order utilizing steam at pressures between 550 and 800 lb. have an aggregate capacity of more than 1,000,000 kw. and the boilers for supplying the steam have a total heating surface of approximately 1,300,000 sq.ft. This record speaks for itself. The commercial economy of higher pressures has been demonstrated.

Because of the fact that the high-pressure turbines

were developed in larger sizes than the boilers, it was necessary in extending Edgar Station to pipe the boilers and turbines in parallel. This materially increased the amount of high-pressure piping and somewhat complicated the steam piping layout. Instead of one main steam header, it necessitated three; i.e., the 1,200-lb. header, the reheat header and the header supplying the normal-pressure turbines. It also required the installation of large banks of safety valves to protect the reheat header and the exhaust piping of the high-pressure turbines.

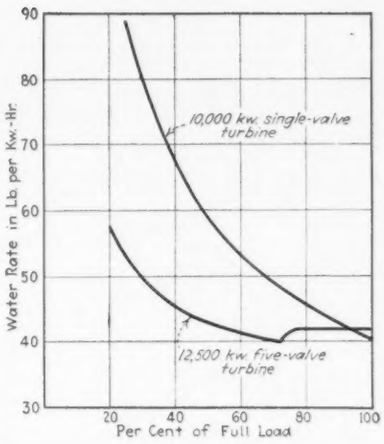


Fig. 3—Water rates of single-valve and five-valve 1,200-lb. turbines

Steadiness of efficiency curve between half and full load on five-valve machine is notable.

Progress in High-Pressure Boiler Design

Our first high-pressure boiler designs, A and B, Fig. 2, have 48-in. forged-steel drums with dry pipes of the customary design. The third design, C, has a 52-in. drum without a dry pipe. The saturated steam is taken from this drum at twelve different points and the result is a material increase in the effective size of the boiler drum. We do not agree with the advocates of smaller boiler drums. We believe that the capacity of the boilers should be increased per section and that the boiler drum should be of adequate size. Furthermore, by delivering the steam to the superheater header at twelve different points along its length, we obtain much better distribution and materially increase the effective size of the inlet superheater header. Engineers who have had trouble with the distribution of steam in superheater headers can readily appreciate the advantages of this change in design.

The first boiler, A, is constructed of 2-in. tubes throughout and, due to the tube size, the section headers are perpendicular to the boiler tubes. The tubes are 15 ft. long and arranged in two banks. The second design, B, utilizes 3¼-in. tubes in the lower deck and 2-in. tubes in the upper deck. The 3¼-in. tubes permit the use of vertical headers for the lower bank, which in turn allow the use of tubes 19 ft. long. This materially improves the shape of the furnace and gives a much better design of boiler. Quite a radical step is taken in the third design, C. The upper bank of boiler tubes is omitted and the boiler made single-pass instead of three-pass. Additional economizer surface is installed to do the work formerly done by the upper bank of boiler tubes.

The superheater in the first design is four-pass across the width of the boiler and is designed for 700 deg. F. total steam temperature. In the second design the superheater is three-pass across the boiler and is designed for 733 deg. F. The superheater in the third design is four-pass from the bottom to the top and is designed for 750 deg. F. In the third design it may be noted that the superheater headers are entirely removed from contact with the flue gases.

The 370-lb. steam reheaters in the two first designs are located above the first and second passes of the boilers below the horizontal circulators. In the third design the reheater is located above the boiler beside the economizer, with a consequent material improvement in accessibility. The reheater in the first design is designed for an outlet temperature of 700 deg. F., and in the second and third designs for 750 deg. F.

The first design has a steel tube economizer with square boxes connecting the ends of the tubes. The second and third designs utilize both economizers and air heaters and the economizers are of the return bend type. In the third design the economizer tubes are hairpin shaped, which reduces the number of joints to approximately one-half the number in the two first designs. The use of air heaters in the second and third designs requires the installation of water-cooled walls on three sides of

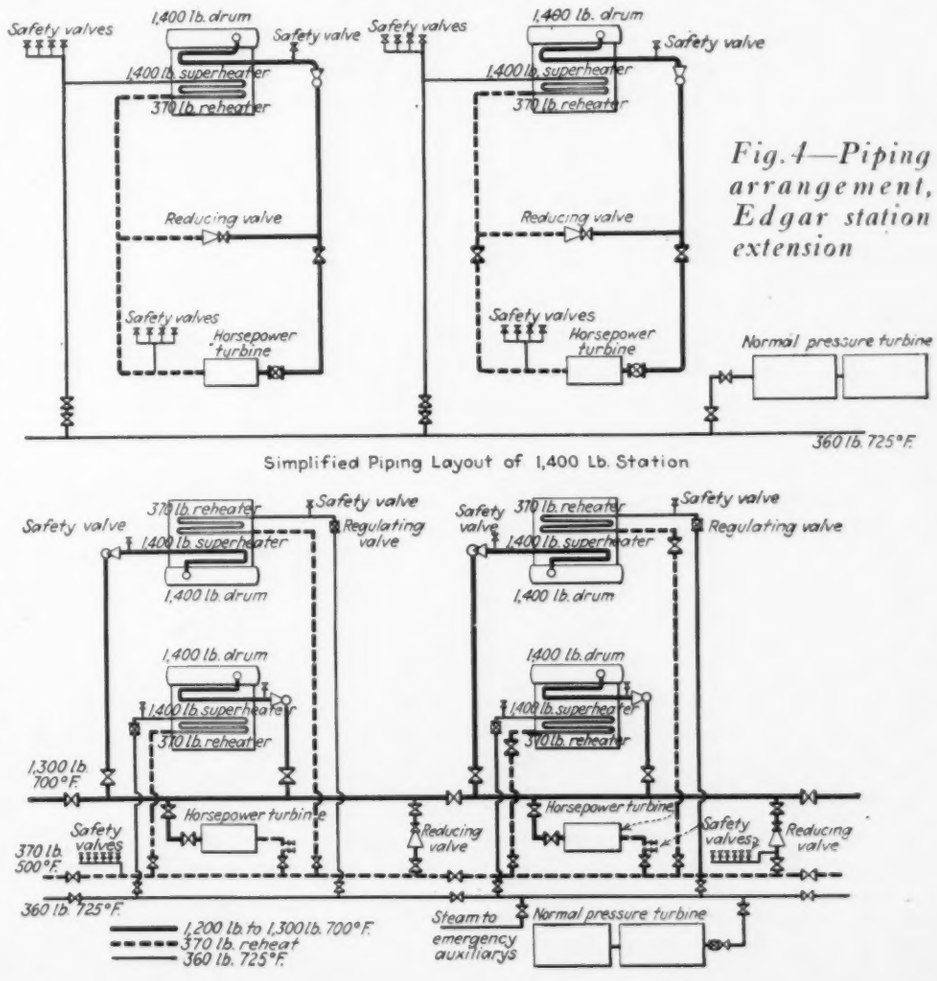


Fig. 4—Piping arrangement, Edgar station extension

the furnaces. The net result of these changes in design has been a lower cost per unit of capacity and a further reduction in the building space required per kilowatt of station capacity without a sacrifice in over-all efficiency.

Double Capacity at 54 per Cent Heating Surface

As indicated in the accompanying table, as the design has developed the area of the boiler heating surface has been reduced 54 per cent, while the capacity has been doubled. We have been trying to distribute

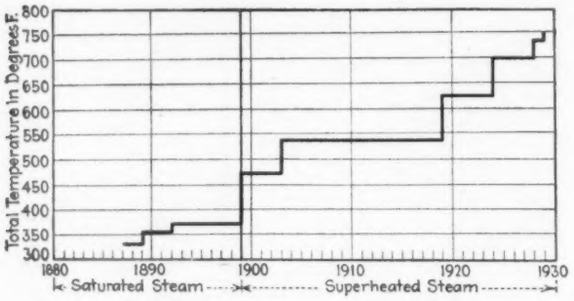


Fig. 5—Steam temperatures used at Boston since 1887

the heat-absorbing surface between the boiler, economizer and air heater so as to get the most economical combination for the steam-generating unit. As the boiler is an expensive item in the high-pressure steam station, such developments are of the utmost importance, for it is only by studying each item carefully that we can expect to lower the cost of the station as a whole.

High-Pressure Turbine Evolution

The first 1,200-lb. turbo-generator was built in 1924 and has a capacity of 3,150 kw. It is a twenty-stage, single-valve machine and after the correction of a few troubles that showed up soon after it was installed it has operated satisfactorily. Since it was the first unit of its kind its design is not the most economical in the use of materials or in B.t.u. per kilowatt-hour generated. The second 1,200-lb. turbine was built for the Milwaukee Electric Railway & Light Company and has a capacity of 7,000 kw. It is similar to the first turbine built, but is more economical in design and performance. The third 1,200-lb. turbine is rated at 10,000 kw. and is installed in the Edgar station. It is also a single-valve machine, but has sixteen stages instead of the twenty employed in the first unit and is more economical. It is also operating satisfactorily.

The big step in the development of the 1,200-lb. turbines was made, however, when the manufacturer was called upon to design the 53,000-kw. cross-compound units for the Deepwater station of the American Gas & Electric Company at Deepwater, N. J. These machines were designed for straight cross-compound operation with all the governing to be done by the 1,200-lb. governor. For this design it was obvious that the single-valve design as built for the first two units at Edgar and Lakeside was not the most economical. To obtain greater economy at loads less than full load called for a multiple-valve turbine. The design finally adopted was a five-valve, fourteen-stage unit. A 12,500-kw. turbo-generator unit of this design is now being built for the Edgar station.

High-pressure turbine design has developed even faster than high-pressure boiler design. High-pressure boilers

Comparison of Size and Capacity of High-Pressure Cross-Drum Boilers, Edgar Station

Boiler number	3	5 and 6	7 and 8
Pressure for which boilers were designed, lb	1,200	1,400	1,400
Boiler heating surface, sq.ft	15,732	15,093	6,971
Superheater surface, sq.ft	2,923	3,483	5,096
Reheater surface, sq.ft	5,938	8,879	6,936
Economizer surface, sq.ft	11,091	5,596	9,634
Air heater surface, sq.ft	0	33,032	29,665
Water-cooled furnace wall surface, sq.ft	0	1,235	1,206
Total surface, sq.ft	35,684	67,318	59,508
Temperature of steam leaving superheater, deg. F.	700	733	750
Temperature of steam leaving reheater, deg. F.	700	750	750
Temperature of feed water entering economizer, deg. F	250	420	420
Capacity in pounds per hour	143,000	250,000	300,000

have doubled in capacity, while the new high-pressure turbine to be installed in the Edgar station this year has four times the capacity of the first high-pressure machine.

Fig. 3 shows the water rate curves of the 10,000- and 12,500-kw. turbo-generator units expressed for comparison as per cent of full load. The improvement in design is apparent. The five-valve design gives nearly the same economy from one-half to full load. It is also interesting that the later designs are considerably less costly per unit of capacity in addition to being more efficient.

The boiler feed pump for the first 1,200-lb. boiler is a 3-in., eight-stage, 3,600-r.p.m. pump designed for a capacity of 300 gal. per minute. To keep pace with the in-

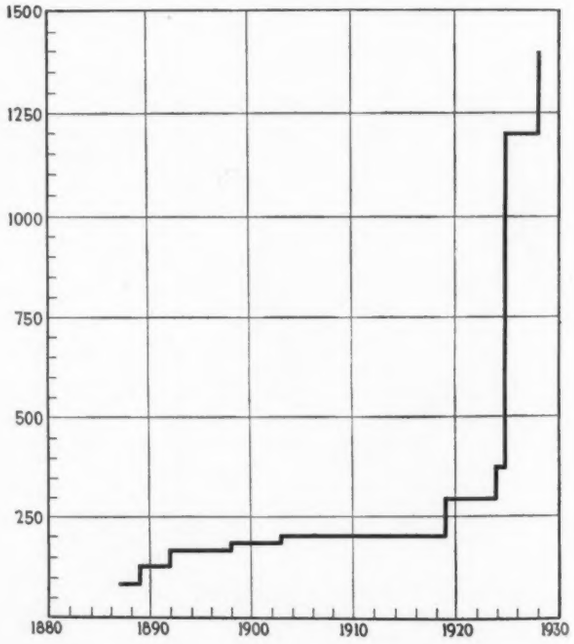


Fig. 6—Steam pressures in Boston Edison practice since 1887

crease in the size of the high-pressure boilers and turbines, pumps with a capacity of 2,000 g.p.m. have been designed, built and are in operation.

Due to our inability to get a suitable 3,600-r.p.m. motor for driving these pumps, it was necessary to go to 1,800 r.p.m. This, of course, required more stages and so the job was accomplished by four pumps in series instead of two, as in the first installation. A primary unit consists of two pumps in series and driven by a 625-hp. motor. These units deliver water at 500 lb. through the

high-pressure heaters to the suctions of the secondary units.

The secondary units received feed water at 450 lb. and boost it to the pressure necessary to feed the 1,400-lb. boilers. These units consist of two pumps in series driven by 2,030-hp. wound-rotor induction motors.

The motors available for this kind of drive are far from satisfactory. There is a real need for a simple variable-speed a.-c. motor with d.-c. shunt motor speed characteristics.

We realize that this boiler feed pump layout is expensive and complicated and hope to simplify materially the boiler feed pump units for future installations.

To regulate the feed to a 1,400-lb. boiler is also a major problem. To handle 300,000 lb. of water per hour with wide variations in differential pressure across the regulator a power-operated feed water regulator has been designed and built and is now in operation. It apparently operates equally well whether the differential pressure across it is 40 lb. or several hundred pounds. It is simple, rugged and satisfactory.

Manufacturers' Aid Important

Much credit is due the manufacturers of this high-pressure equipment. We do not have adequate words to express our admiration of their resourcefulness, ability and tenacity. It is indeed encouraging to know that they stand ready to meet such rigorous requirements.

We all know that the cost of steam-electric generating stations is still too high irrespective of the operating pressure employed. What are some of the possibilities of the future?

Fig. 4 shows at the bottom the piping diagram of the four boilers, two high-pressure turbines and one normal-pressure turbine piped in parallel. This requires three steam headers with all the necessary valves, fittings and piping to a double row of boilers. Because of the double row of boilers the piping to the row of boilers farthest from the turbine room is necessarily rather long.

If boilers of the same capacity as the full load steam demand of the high-pressure turbines are used, they can be placed in one row adjacent to the turbine room and the piping materially simplified, as shown by the piping arrangement at the top of Fig. 4. One-quarter the number of valves and fittings will be required, only one 360-lb. header instead of the three headers required in the lower diagram, and the connections between the boiler, turbines, and reheaters will be much shorter. In a similar manner, the boiler feed piping, service water piping and electrical connections for the boiler auxiliaries will be simplified. Such a change will result in a substantial reduction in the cost of the station and, furthermore, will reduce maintenance and operating labor and simplify operation.

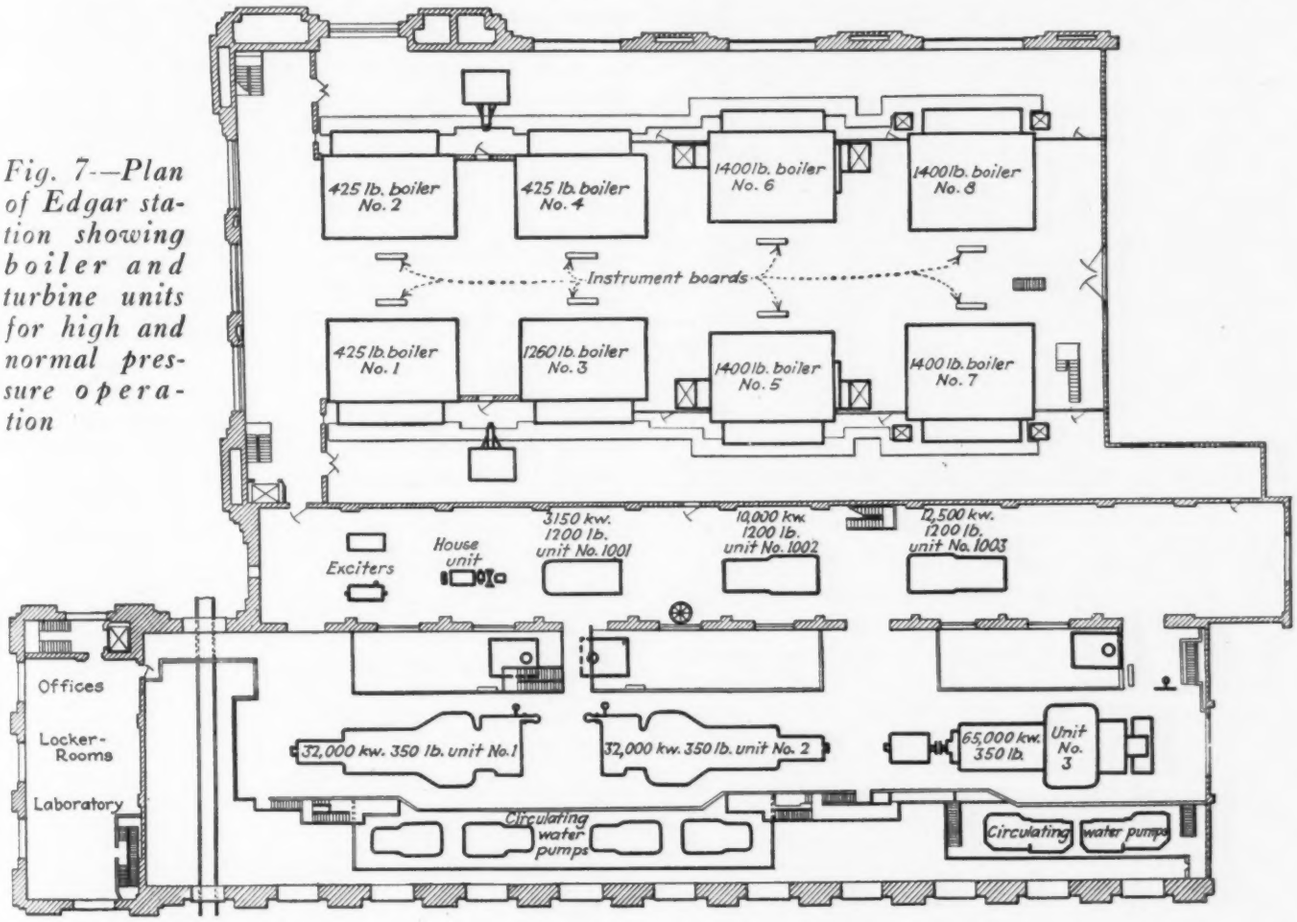

425 lb. boiler No. 2
425 lb. boiler No. 4
1400 lb. boiler No. 6
1400 lb. boiler No. 8
Instrument boards
425 lb. boiler No. 1
1260 lb. boiler No. 3
1400 lb. boiler No. 5
1400 lb. boiler No. 7
Exciters
House unit
3150 kw. 1200 lb. unit No. 1001
10,000 kw. 1200 lb. unit No. 1002
12,500 kw. 1200 lb. unit No. 1003
Offices
Locker-Rooms
Laboratory
32,000 kw. 350 lb. unit No. 1
32,000 kw. 350 lb. unit No. 2
65,000 kw. 350 lb. Unit No. 3
Circulating water pumps
Circulating water pumps

Fig. 7—Plan of Edgar station showing boiler and turbine units for high and normal pressure operation

Neither of these diagrams shows a straight cross-compound layout where the back pressure on the high-pressure turbine varies with load. Both diagrams are laid out on the basis of maintaining a constant back pressure on the high-pressure turbines. We feel that there are very important advantages in this arrangement.

We believe that a substantial saving in building costs can be accomplished by the utilization of a design with a better balance between the size of boiler units and turbine units. If not more than two boilers are employed per

turbo-generator unit, and preferably one, the size of the boiler plant buildings can be reduced approximately 40 per cent. If the coal bunker is built as a separate structure, and the forced draft and induced draft fans, cinder catchers and flues are placed on the roof, we believe that the cost of the boiler plant building can be reduced by almost the same percentage. Fewer boiler units per turbine will reduce the cost of practically every item that enters into the cost of construction of the boiler plant. We believe that the progress in design is in this direction.

The utilization of vertical condensers may allow a reduction in the size of the turbine rooms.

The building of more of the equipment, both mechanical and electrical, for outdoor installation offers interesting possibilities.

In conclusion, we believe, first, that a properly designed high-pressure station can be built for approximately the same unit cost and will show a material improvement in economy as compared with a moderate pressure station; second, that the ultimate in the commercial economy of steam-electric generating stations has not been achieved. It is "up to" the station designers and the equipment manufacturers to keep up the good fight and by the application of our growing fund of knowledge and cold-blooded economics to carry on the work of lowering the cost of generating electrical energy. This work is essential to the continued success of the industry.

Performance of Capacitor Motors Established by Test*

AS THE result of performance tests on a ¼-hp., 110-volt, 60-cycle, four-pole motor with equal windings in the capacitor and main phases the accompanying data were obtained.

**As reported by H. C. Specht at the winter convention of the American Institute of Electrical Engineers.*

A New Transmission Line Atlas

AN IDEAL transmission and power-system map of the United States would (1) show the entire country in one view, would (2) be a handy size for desk use, would (3) locate and (4) differentiate between hydro and fuel generating stations, (5) give their ratings, (6) indicate every community served, (7) chart each line from town to town, whether of high or low voltage, (8) mark the voltage, (9) designate the ownership of the various properties and (10) automatically keep itself corrected as extensions occur or as properties change hands. The list could probably be amplified, but the preceding enumeration will at least suggest some of the difficulties confronting the prospective compiler. Obviously some of these specifications are incompatible among themselves. Any compilation must therefore favor certain ones and sacrifice others.

A recent publication by the Art Craft Reproduction Company of New York meets five of them, namely, Nos. 2, 3, 6, 7 and 9, and goes as far as it can toward satisfying No. 10 by binding individual state sheets in loose-leaf form, to be revised one at a time.

For the base, U. S. Geological Survey state maps have been used, reduced to a common size or sectionalized to go on 14x20-in. sheets. These maps contain a wealth of detail—streams, railroads, county lines, names of towns and villages—but have been made light enough to let the surcharged color stand out clearly. Transmission lines—using the term broadly—are in color, numbered according to a key to designate the company name or ownership. Though a method to distinguish the individual companies of each holding-company group would be desirable, the increased complexity of the maps, especially in the more crowded states, would probably more than counterbalance the added information. Municipal plants are indicated by a separate symbol.

Full-Load Performance as Affected by Capacity

Capacity in μf.	Line		Main Phase		Capacitor Phase			Capacitor, Volts	Pull-out Torque in Oz.-Ft.
	Amp.	Watts	Amp.	Watts	Volts	Amp.	Watts		
22	2.6	269	2.37	179	98	1.25	90	150	24
33	2.45	265	1.73	110	115	1.94	155	158	26
44	2.7	283	1.22	53	126	2.85	230	172	29.5
64	4.2	398	0.55	—25	154	4.55	423	189	34

Comparative Performance for Capacitor and Split-Phase Motors with Equal Starting Torques

(1) As Capacitor Motor	Main Phase			Aux. Phase			Line			Per Cent Eff.	Per Cent Power Factor	Capacitor		Oz.-Ft. Torque		
	Volts	Amp.	Watts	Volts	Amp.	Watts	Volts	Amp.	Watts			Volts	Mfd.	Full-Hand	Pull Out	Starting
No load	110	2.8	12	247	0.8	86	110	2.65	98	....	....	276	7.5	0	..	..
Full load	110	3.4	219	231	0.7	72	110	3.63	291	64.2	73	250	7.5	12	41	..
Locked	110	19.	1640	92	1.92	148	110	19.4	1715	....	....	118.5	45	..	..	26
(2) As Ordinary Split-phase Motor																
No load	110	3.71	96	...	....	....	110	3.71	96	....	....	...	.....	..	..	..
Full load	110	4.61	311	...	....	....	110	4.61	311	60	61.2	...	.....	12	39	..
Locked	110	22.0	1805	110	20.2	1980	110	41.6	3785	....	....	...	.....	..	..	26

Speed Varies with Capacity Involved

Main Phase			Capacitor Phase			Line			Capacitor,		
Volts	Amp.	Watts	Volts	Amp.	Watts	Volts	Amp.	Watts	Volts	R.P.M.	Mfd.
110	1.6	0	102	0.65	50	110	1.15	47	163	1798	10.6
110	1.475	—27	112	1.05	81	110	0.775	52	171	1798	16.3
110	1.31	—137.6	159	3.32	294	110	2.13	156.4	196	1795	45.3
110	1.7	—168	179	5.02	493	110	4.12	318	204	1790	64.8
110	2.25	—147	202.5	6.83	722	110	6.38	578	202	1775	88.5
110	3.28	— 25	214.5	8.64	990	110	9.63	990	185	1760	126
110	5.1	+390.5	201	9.26	950	110	12.15	1320	132	1730	188
110	6.0	+571	183	9.0	840.5	110	12.6	1365	100	1690	239
110	6.35	+681	160	8.8	645	110	12.4	1295	65	1610	315

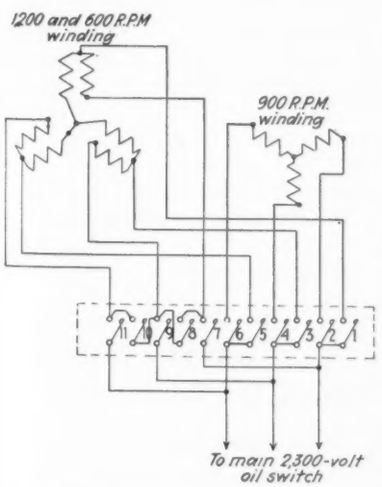
This atlas ought to be of use particularly to financial houses, engineering reference libraries and others interested in the location rather than engineering details of plants and lines. It usefully supplements the information given in other reference works, notably the Central Station Directory and the Bonbright Survey of Electric Power and Light Companies in the United States. It is proposed to keep the loose-leaf folder of maps up to date by sending corrected maps at frequent intervals.

Fan Motor Speed Controlled by Eleven-Pole Switch

By A. H. Beiler
Engineer American Gas & Electric Company

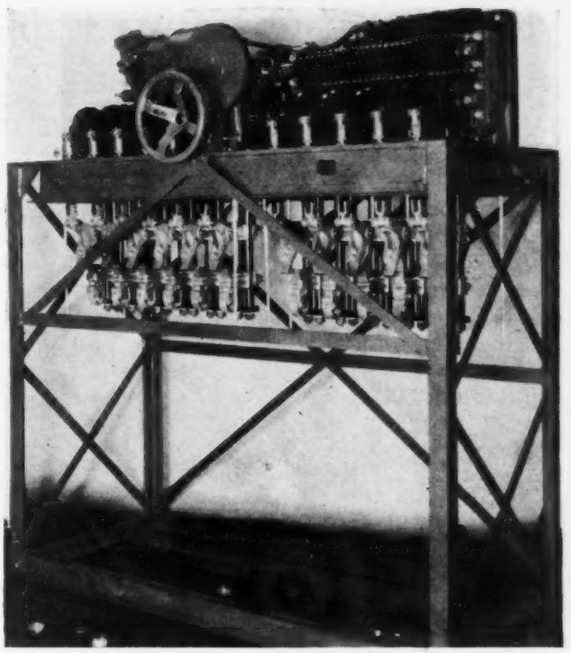
SEVERAL novel control features are embodied in the oil-immersed contactor built by the Westinghouse Electric & Manufacturing Company for the Ohio Power Company to be used for controlling a group of two- and three-speed, 2,300-volt pole-changing squirrel-cage induction motors driving the draft fans at the Philo power station. These contractors are rated at 300 amp., 4,500 volts, and the specifications call for a momentary carrying capacity of 30,000 amp. The contacts are cam operated and oil insulated.

On the particular installation connections are made so that speeds of 600, 900 and 1,200 r.p.m. are obtained by the closing of certain groups of contacts. For 600 r.p.m. contacts 7, 9 and 11 are closed, for 900 r.p.m contacts 2, 4 and 6, while for high speed on 1,200 r.p.m. contacts 8, 10, 1, 3 and 5 are closed. These contact arrangements regroup the poles of the fan motors for all speeds except for 900 r.p.m. where an electrically independent winding is used.



Circuit diagram of a three-speed control eleven-pole oil circuit breaker

The controllers are furnished with 25 auxiliary cam-operated contacts to provide for the special operating requirements. The draft fans are very large and heavy and large amounts of energy are stored in their rotors when running at full speed. If the motor driving the fan is disconnected from the supply this stored energy is slowly dissipated in friction and windage. If the motor is immediately transferred from the full speed winding to a lower speed winding the fan rapidly tends to decelerate to this speed, giving up its energy to drive the motor as a generator. This imposes a heavy braking duty on the fan and creates severe stresses in the fan blades. What is required, therefore, is to connect the motor to the lower speed winding only after the fan has decelerated to this speed. For this purpose a tachometer is connected to the draft fans so as to inform the operator at what point to close his lower speed switch. Obviously, in going from low to high speed this is not required, as in that case the stress caused by the electric current is on the motor, which on account of its small rotor and rigid construction is better able to take care of this condition.



Eleven-pole circuit breaker with three-speed motor control mounted without cover plates

The operation of the equipment is as follows: If the control station is momentarily closed in the "raise" direction the control circuit seals itself in and the switch moves to the first speed position. If the operator has kept the control station closed the switch will nevertheless stop at this first position. To move to the next position the circuit at the control station must be opened and again closed.

In coming from a high to a lower speed, however, the switch does not complete a travel from one speed point to the next. It stops in an intermediate position, thus keeping all circuits to the motor open. The operator, by watching his speed indicator, can see the gradual deceleration in speed of the fan and will close the circuit to move to the next lower point when the fan has come to the proper speed.

The usual interlocks, limit switches and pilot lamp contacts are provided and the primary oil switches are closed and tripped with the contactor in the "off" position.

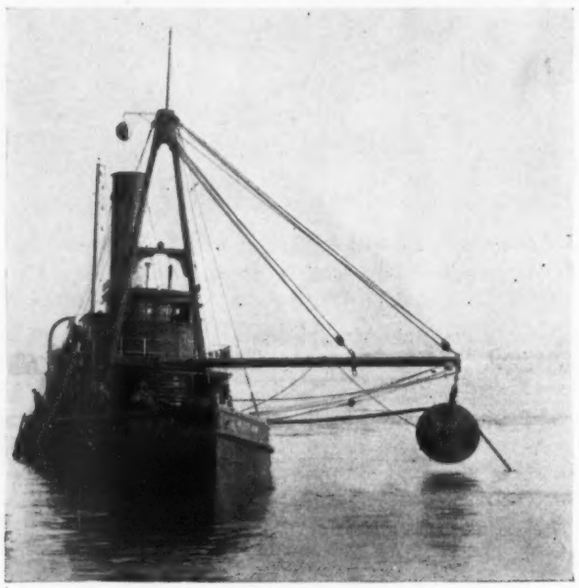
ALTHOUGH the money is least of the harm, accidents cause money wasted that might better have been spent in compensation to the workers in the organization, or in adding to the facilities for the performance of our service. Although the company bears the financial loss from the accidents, that doesn't relieve us, the individuals who constitute it, from the moral responsibility of the injury and the harm resulting from our carelessness.

—P. S. Arkwright,
President Georgia Power Company.

Handling Submarine Cable in Long Lengths

THE laying of five submarine cables, each 3,935 ft., under the East River, New York, has been recently completed. With a capacity of 15,000 kva. each, the cables will operate at 27,600 volts, which is believed to be the highest ever attained on rubber-insulated cables. They tie together the Hell Gate generating station of the United Electric Light & Power Company and the New York & Queens Electric Light & Power Company.

Each cable consists of 2,605 ft. of 350,000-circ.mil three-conductor non-leaded cable with 70 ft. of three-conductor 600,000-circ.mil lead-covered cable spliced on



Cable-laying boat, "Western Union," docking at Hell Gate shore

The cable is being fed into the water over the sleeve.

one end and 260 ft. on the other. A larger size of cable was necessary for the end pieces inasmuch as they would not be immersed in water, and therefore would have a smaller carrying capacity than the center portion. The lead sheath was necessary for the ends to prevent the corona cutting that would occur by operating in air. The three pieces were spliced together by factory splices at the place of manufacture, the Okonite Company, Passaic, N. J.

The use of rubber covering was necessary because of the conditions to be faced during installation. Manufacturing the cable in single pieces to eliminate all splicing was impossible. Splicing during installation was prevented by tidal conditions. Rubber cables were deemed best as splices on them could be made an integral part of the cable without increasing the over-all diameter.

The cables were transported from the factory in gondola cars to Jersey City, N. J., where the cars were placed on railroad floats. Near the point of installation the cable was transferred from the gondola car to a cable-laying boat. A special sheave with an outside diameter of 6 ft. was suspended from a derrick boom and a power reel on the cable boat pulled the cable from the gondola over the sheave to the boat, where it was reeled. The length of cable that could not be accommodated on the reel was stretched over to a scow fastened to the side of the boat.

With one cable reeled, the boat and scow moved up the river and anchored about 400 ft. off shore, the shallowness of the water in that area preventing the boat from coming closer to the shore. A small pontoon, with steel pulling lines attached to trucks on the shore, took one end of the cable and by power from the trucks pulled the cable to the shore, where it was securely anchored. The boat and scow then moved off toward the Hell Gate shore, and by tension provided by the anchored end the cable was unreeled as the boat moved.

At Lawrence Point the cables were brought up through cribbing into a cable house, where they were spliced to land cables leading to the various distributing stations of the New York & Queens Electric Light & Power Company. At the Hell Gate shore the cables were spliced to the land cables leading to the Hell Gate station. The cables were anchored at both shores.

Voltmeter Chart Form

INFORMATION required by state commissions in reference to routine or complaint tests of secondary voltages is specific and detailed. It is the usual practice to supply that information on a separate sheet identified to the particular voltage chart. However, there is no reason why the information should not be on the chart itself, and it certainly would be less liable to be lost or confused with another record. So argued the Illinois Northern Utilities Company, Dixon, Ill. Accordingly forms were printed, circular in shape and of a size to cover the center area of the ordinary round chart. The forms are pasted on the charts.

The information blanked on the form covers the file number, town, substation, address where chart was made, transformer location and size, circuit number, phase designation, distances from substation and transformer, two or three-wire secondary, longest section in secondary, instrument identification, period of record, time set and time removed, voltage and time corrections, maximum and minimum volts during daytime and lighting load hours, survey or complaint record, remarks and name of the man who made the test. Each chart is thus permanently identified and carries on its face, along with the voltage record, all of the essential information.

Lamp Life Longer When Flashing than on Continuous Burning*

WITH the erection of the sign on the Westinghouse Building in Philadelphia it was decided that an accurate record of lamp renewals would be kept to determine the effect on lamp life by alternately flashing them on and off.

The sign under test contains 2,992 sockets which burn continuously and 1,257 sockets which are flashed eight times per minute, lamps being "on" 50 per cent of the time. The burning hours per year are slightly over 2,000 hours.

It is interesting to note that during the first 6,000 hours there were 3,342 renewals per 1,000 sockets in the continuous burning section and 1,518 per 1,000 sockets in the flashing section, indicating a longer life to lamps in flashing service. This was probably due to the length of time necessary for lamp filaments to heat up after being turned on.

**From report of N.E.L.A. advertising committee, January, 1929.*

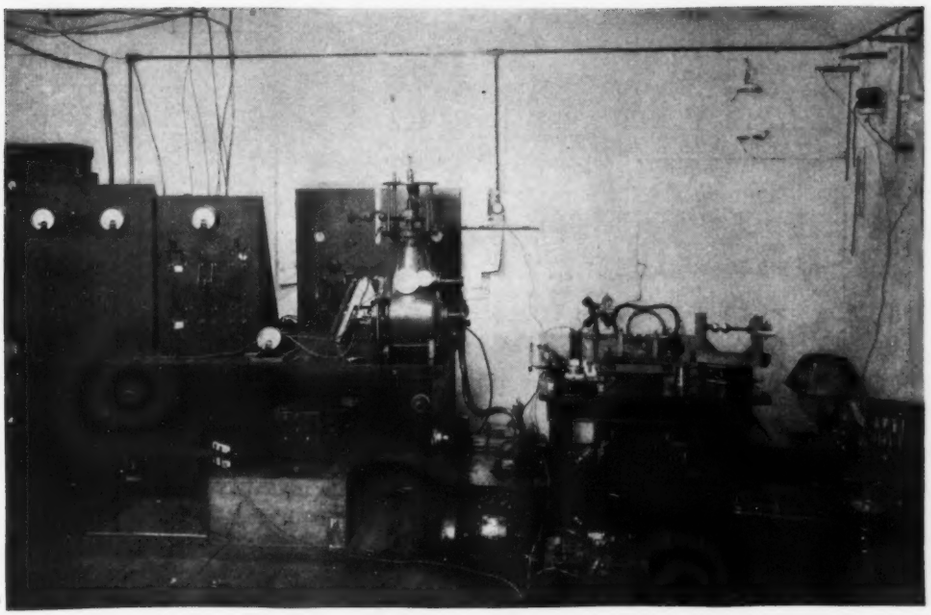


Fig. 1—Cathode-ray oscillograph test laboratory showing the six conductors leading in from the transmission line. This 5-mile transmission line had been in operation at 22 kv.

Lightning Surges Measured

Five-mile transmission line used to measure effects of surges from lightning generator. Effects of choke coils and arresters. Theory checked by experiments

By A. M. Opsahl

Supply Engineer Westinghouse Electric & Manufacturing Company

MANY calculations have been made on the reactions occurring on a transmission line when subjected to surge voltages of short duration, but measurements of such surge voltages had been made on short low-voltage lines and circuits with lumped constants only. It was desired to make some measurements using a transmission line of a practical type that was long enough to hold the entire traveling wave so that it would momentarily be entirely free from all effects of terminal apparatus. In this way no theoretical assumptions need be made and a direct check on the results obtained in the laboratory would be given. Although a long transmission line with both ends terminating in the laboratory was not available, the use of an idle 5-mile length of a normally 22-kv. two-circuit line was obtained through the courtesy of the Duquesne Light Company. A small test laboratory was built at each end of the line and a circuit was devised by which it was possible to synchronize the Dufour cathode-ray oscillograph with the transient from the other end of the line.

The results obtained indicate that short traveling waves on a transmission line behave very much as the theories indicated. The surges used were in the order of those Dr. Norinder* and others have found to result from a lightning discharge. Some of the phenomena that were predicted by these theories were observed and recorded as follows:

Traveling waves move with the velocity of light over the conductors.

Traveling waves on reaching the open end of the line fold up on themselves and reflect back on the line with the same polarity. Traveling waves reaching the grounded end of the line are reflected back on the line with reversed

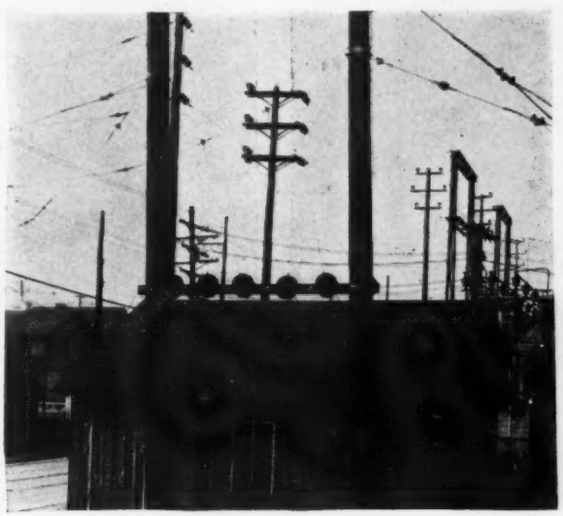


Fig. 2—Experimental set-up showing the Dufour cathode ray oscillograph with its auxiliary apparatus and some test apparatus

"Cathode-Ray Oscillograph as Used in the Study of Lightning," Dr. H. Norinder, A.I.E.E. "Transactions," 1928, page 446.

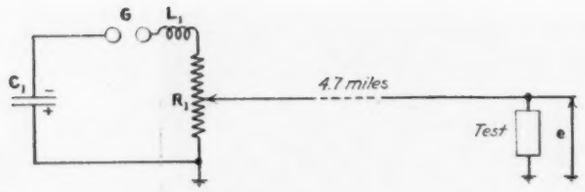


Fig. 3—Simplified circuit for applying a surge voltage directly to the transmission line

The shape of the surge is determined by the constants of the surge generator. C_1 is a capacitor, L_1 an inductor and R_1 a resistor. The oscillograph potentiometer is connected in the position *e*.

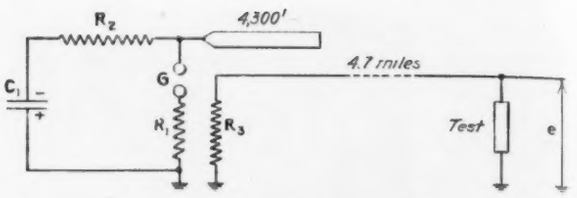


Fig. 4—Simplified circuit for obtaining a square surge by releasing a bound charge

The 4,300-ft. cloud is discharged aperiodically through R_1. The resistor R_3 absorbs most of the surge that is reflected from the test end of the line.

polarity. When the line is terminated with a resistance equal to its surge impedance the traveling wave is absorbed.

A transmission line has the characteristic of surge impedance that limits the current a traveling surge voltage will deliver in the same way that a resistance would limit it. This surge impedance for a single conductor is in the order of 400 or 500 ohms, depending on the surroundings.

A lightning arrester at the end of the line can limit the voltage and absorb energy from the surge.

The range of protection of a terminal lightning arrester to line insulation depends on the surge wave front.

Line flashover results in line oscillations.

A choke coil will slope off a very steep wave applied to a transformer.

Two methods were used for generating the traveling wave. The simplest and most obvious way was to surge the line directly from the usual surge generator,† as shown in Fig. 3. The other method, proposed by A. L. Atherton, is shown in Fig. 4. Here a bound charge is released by discharge of the cloud units. Typical oscillograms of these two types of surges as measured at the far end of the transmission line are shown in Figs. 5 and 6 respectively.

The oscillogram in Fig. 5 is replotted with a linear time scale as e_1 in Fig. 7. Here we see the successive

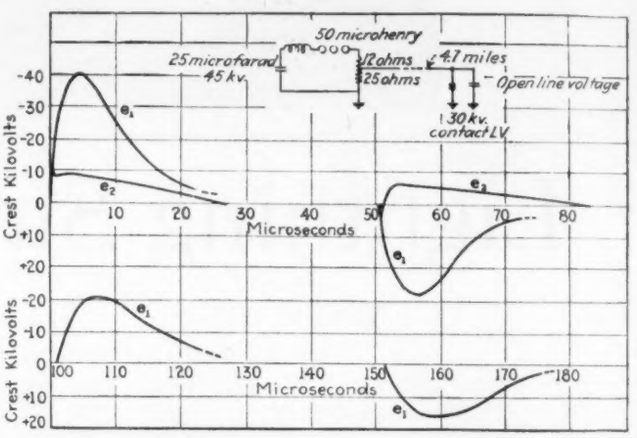


Fig. 7—Oscillograms in Figs. 5 and 8 replotted with a linear time axis

The line was surged directly as shown in Fig. 3; e_1 is the voltage on the open line; e_2 is the voltage on the line as limited by the operation of a 3-kv. lightning arrester.

†"*Surge Generating Equipment*," D. F. Miner, "*Electric Journal*," *Vol. 23, page 596, December, 1925.*

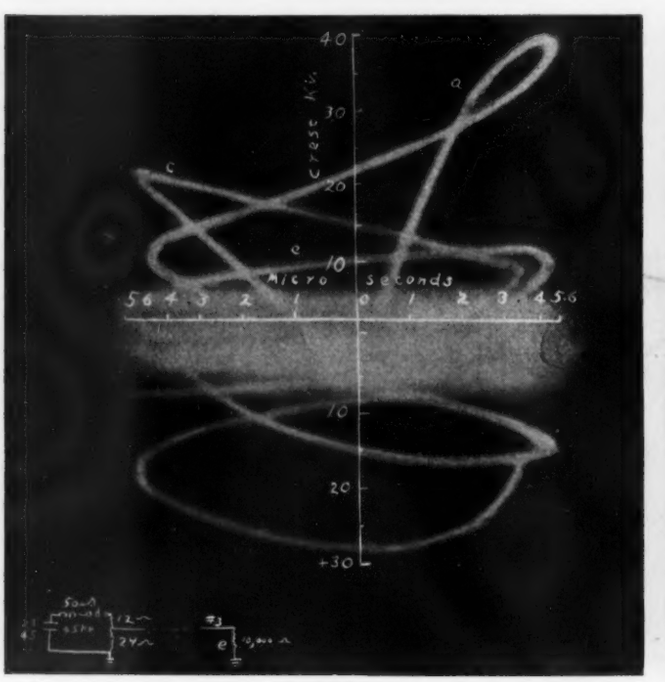


Fig. 5—Surge voltage reflections when line is surged directly as in Fig. 3

The surge voltage applied was 24 kv., but this rose to 40 kv. at the open end of the line.

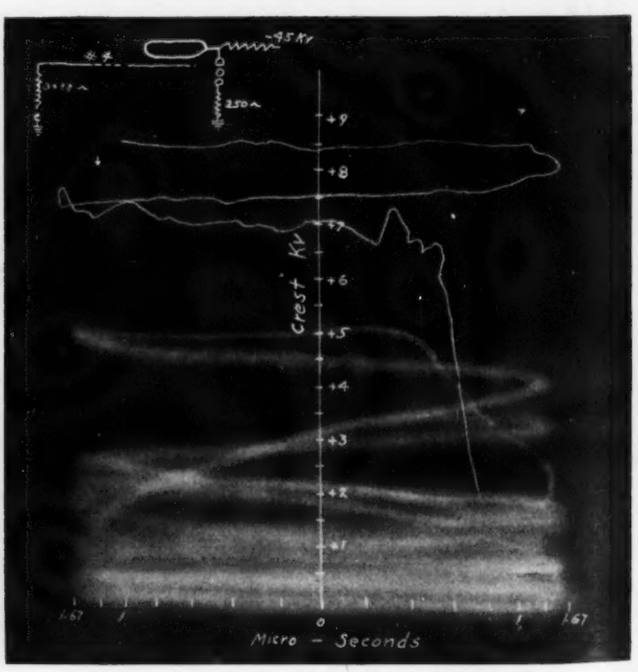


Fig. 6—Reflections of a square surge on the open line

The circuit was induced by the cloud method shown in Fig. 4; R_3 was removed.

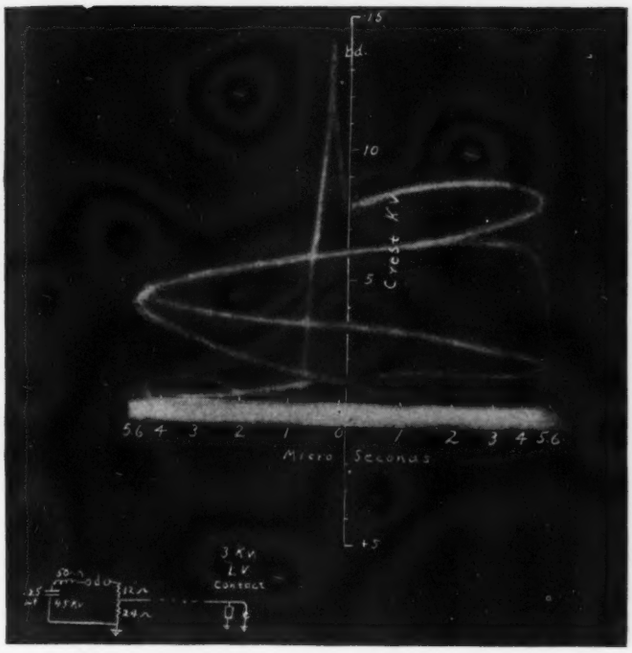


Fig. 8—An oscillogram showing the modification of the surge in Fig. 5 when the line is terminated with a 3-kv. arrester

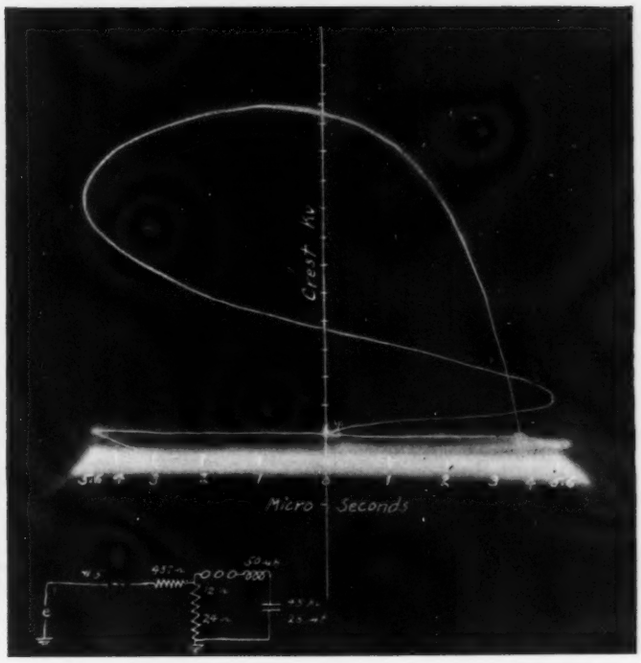


Fig. 9—The reflections that appeared in Fig. 5 are here absorbed by a resistor at the surge generator end of the line

In Fig. 9 the resistance was slightly higher than the surge impedance of the line

reflections of the surges back and forth along the line. Between the fronts of the successive waves there is a time interval of about 51 microseconds. This is the time taken for an impulse to travel from one end of the line and return. As was expected, the surge voltage traveled along the conductor with the velocity of light, which is about 1,000 ft. in one-millionth of a second. Looking at the plot in Fig. 7 as a space-voltage curve instead of a time-voltage curve each microsecond is taken as representing about 1,000 ft. of conductor. This curve indicates that the surge was just a trifle longer than the line itself.

The oscillogram shows that the successive reflections arrived at the measuring end of the line with alternately negative and positive polarity. This surge arriving at the open measuring end of the line folded back on itself and the voltage rose to almost double the applied value. The applied voltage was 24 kv. negative polarity. This impulse reflected back to the surge generator with the same polarity. The surge generator, being practically a short circuit from line to ground, reflected the surge back on the line with reversed polarity and only a small change in magnitude. Following this sequence of events we get the impulses at regular intervals as is shown.

The decrement of the wave that could be attributed to its travel over the line was 1.4 per cent between the first and second measured waves and 0.6 per cent per mile between the third and fourth measured waves. Only four of the reflections are plotted in Fig. 7, but additional impulses can be seen on the original oscillogram, Fig. 5. Between the first impulse and the fourth impulse the wave front had lengthened from 4 to 7 microseconds.

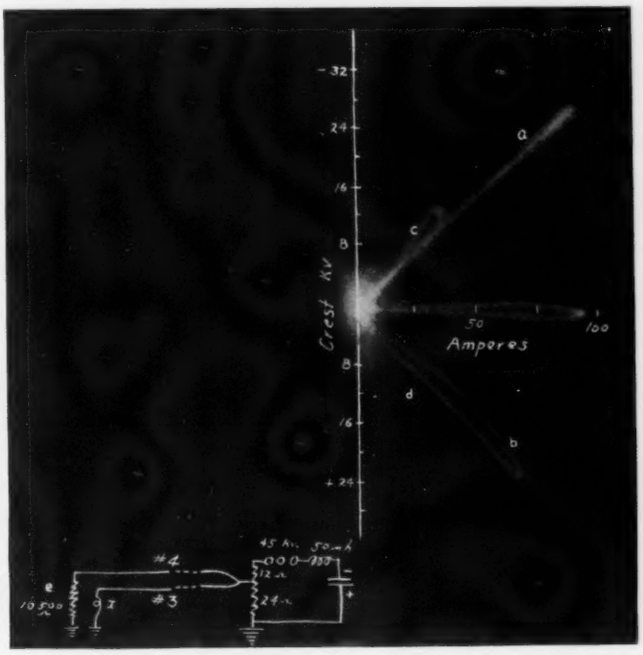


Fig. 10—The volt-ampere characteristic of a traveling surge on transmission line conductors

The current was measured in one conductor and the voltage was measured on the other conductor when the two conductors were surged in parallel.

In Fig. 6 we have the reflections of a surge induced by the cloud method. Here the reflections are all of one polarity, as would be expected in an open line. The wave front between two successive reflections changed from 0.3 microseconds to about 2 microseconds. In two other cases the change was in that same magnitude. If the voltage of these surges had been well above the corona point a much higher decrement would be expected. Klydonograph data indicate such an effect.‡

A contact type 3-kv. autovalve lightning arrester

‡"*Klydonograph Surge Investigations*," *Cox, McAuley and Huggins*, "*Transactions*" *A.I.E.E., Vol. 46, page 327, 1927.*

was connected from line to ground and the line surged as recorded in Figs. 5 and 7. The oscillogram of the voltage across the arrester is shown in Fig. 8. This was replotted as e_2 in Fig. 7. The lightning arrester limited the surge to a much lower voltage and absorbed sufficient energy from that surge so that the protected apparatus would be subjected to two impulses of a relatively low value instead of quite a number of applications of a much higher surge voltage.

If the arrester in the preceding case had been one with too low an effective impedance or resistance it would have held the voltage across the apparatus down to a lower value. However, there would have been a smaller absorption of energy and the surge would have reflected back on the line with small change in magnitude to do damage elsewhere. The reflections with reversed polarity resulting from a low resistance from line to ground were shown in Figs. 5 and 7. At any instant

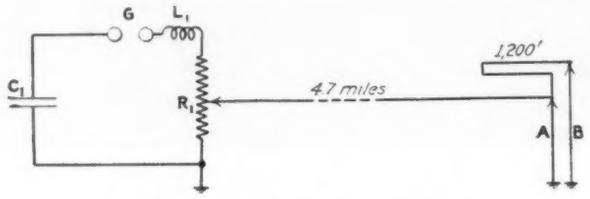


Fig. 11—Circuit by which it was possible to get equivalent of two points on the transmission line available at the oscillograph

A loop of a section of the two upper conductors was connected to one of the lower conductors.

the doubled surge voltage divides in proportion between the effective impedance of the terminal apparatus and the surge impedance of the line.

When the line is terminated by a resistance equal to the surge impedance of the line, which in this case was 430 ohms with the two lower conductors grounded, there is no effect of the surge folding back on itself and increasing in terminal voltage and there is no reflection back on the line. This effect is shown in Fig. 9. The line was surged through a resistance slightly higher than the surge impedance of the line. When the surge reflected back to the surge generator it was almost completely absorbed and only a small voltage of the same polarity was reflected back to the measuring end of the line.

When the resistance at end of the line is greater than the surge impedance of the line the surge folds up in itself, increases in voltage at the end of the line and reflects back on the line with no change in polarity. When the terminal resistance is less than the surge impedance of the line the surge is reduced in

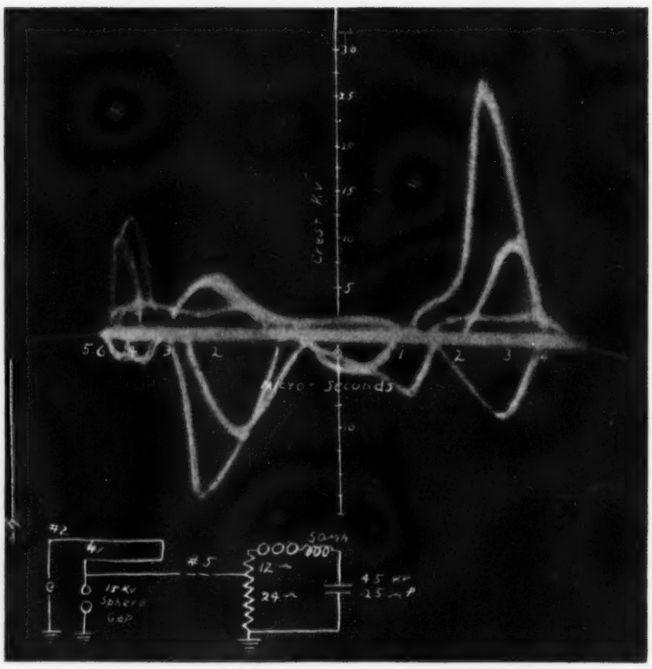


Fig. 12—An oscillogram showing the oscillations between A and B in Fig. 11 after flashover of a 15-kv. sphere gap at A

Note the rise in voltage at the open end of the line.

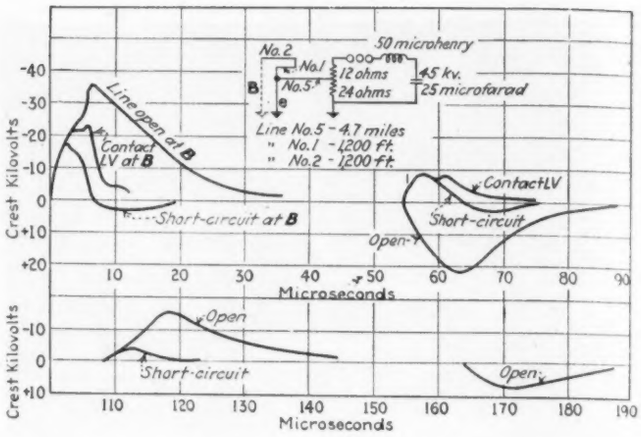


Fig. 13—Oscillograms replotted together on a linear time axis

This shows the effect of terminal conditions on the voltage 2,400 ft. out on the line. Three conditions are shown with the same applied surge voltage. The line is either open, grounded or terminated with an arrester.

voltage at the end of the line, but is reflected back on the line with reversed polarity. Some of the surge is absorbed in the terminal resistance. These two effects were seen in Fig. 7. This absorption is complete when the resistance equals the surge impedance. There is no absorption when the line is entirely open or is shorted to ground through zero resistance.

A test was also made to show the relation between current and voltage in a traveling surge. The closest approach to making a true measurement of this relation was to measure the current in one conductor and the voltage on the other conductor when they are surged in parallel, as in Fig. 10. A current coil connected one conductor directly to ground and measured the current. The first impulse rises and falls along the same line, a straight line. This indicates that the current and voltage are in phase and that there is an impedance to the flow of surge current that is independent of the current. The surge impedance in this condition is 310 ohms. The voltage on the potential conductor seems to have been decreased by the adjacent grounded conductor, as it is only 28 kv., as compared to 40 kv. before in Fig. 7. If we take this value, 40 kv., we get a surge impedance of 440 ohms. The surge impedance of one conductor as measured by the spark gap method varied from 490 to 400 ohms, depending on which of the other conductors were grounded.

The test line was so arranged that the two upper conductors could be used as an extension of the conductor below. This loop of the conductors has a length of 2,400 ft. This gave the equivalent of two

points on the line being available at the test station, as shown in Fig. 11. A sphere gap was connected in the *A* position and the line was surged as before. The voltage measured in the *B* position is shown in Fig. 12. It indicates the overpotential effect at the end of the line and the reflections of this chopped wave over this section of the

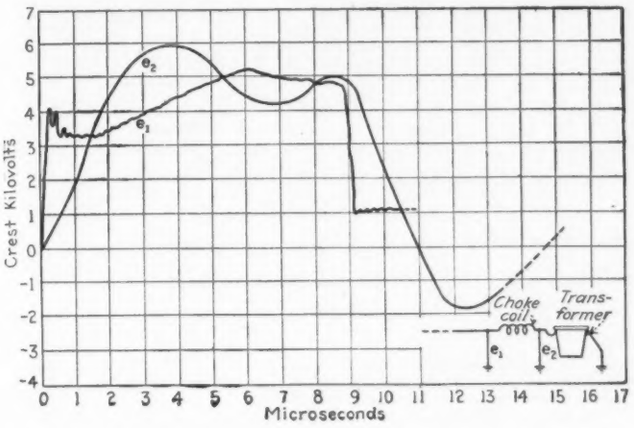


Fig. 14—Oscillograms replotted with a linear time axis. e_1 is the voltage on the line side of the choke coil; E_2 is the voltage across the transformer

line that was isolated by the breakdown of the spark gap. This is similar to the effects observed on klydonographs when they indicate oscillatory surges and system records show an insulator flashover.¶

Some additional oscillograms were taken to show how the terminal conditions at position *B* affected the voltage at *A* when surged as before (Fig. 13). This is the equivalent of measuring the voltage out on the line 2,400 ft. from the terminal apparatus. When we have such a condition there can be no influence of the terminal apparatus on the surge at the measuring point until 4.8 microseconds after the front of the surge has passed the point going in the direction of the terminal apparatus. We depart somewhat from that condition here as there is some influence of the adjacent conductors on each other.

¶*"Transmission Line Voltage Surges," J. H. Cox, "Transactions A.I.E.E., Vol. 46, page 338, 1927.*

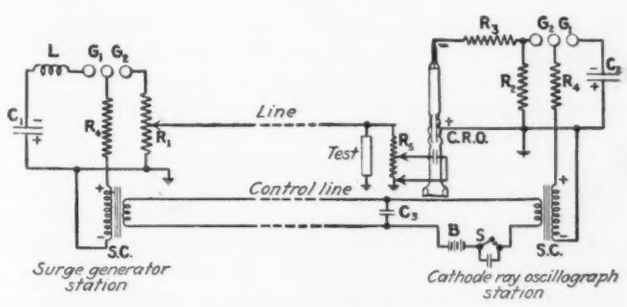


Fig. 15—The hookup used to synchronize the surge generator and the cathode-ray oscillograph when separated by a distance of 4.7 miles

The capacitors C_1 and C_2 are held at constant potential. Opening the switch *S* gives an impulse of voltage across the spark coils. This breaks down the gaps G_1 and G_2 thus exciting the oscillograph and applying the surge voltage.

C_1, C_2—50-kv. capacitors.
C_3—1,000-volt capacitor.
L—Inductor.
G_1 G_2—Sphere gaps.
R_1—A low resistor.
R_2, R_3, R_4, R_5—High resistors.
S. C.—Spark coil.
S.—Switch with a quick break.
B.—Storage battery.
C. R. O.—Dufour cathode-ray oscillograph.

In order to get steep surges the scheme shown in Fig. 4 was used and the wave shape used in the choke coil tests is shown as in Fig. 14 e_1. When surges of very steep wave front enter a transformer the voltage tends to pile up across the first few turns or coils and the insulation is stressed unduly. A modification of the wave front improved this condition. In the case considered here the voltages on the open line and on the entering terminal to the choke coil and transformer system were almost identical. This indicated that the voltage does pile up in front of this choke coil as was expected. The voltage entering the choke coil and the voltage between the choke coil and transformer are shown in Fig. 14. It shows that the voltage across the transformer e_2 has a very much slower wave front than that of the applied wave e_1, in the relation 0.3 to 3.8 microseconds. The effect of the choke coil on the incoming wave, of course, depends on the steepness of the incoming wave, the equivalent electrostatic capacity of the transformer system and the magnitude of the inductance of the choke coil used.

Over-all Cost of "White-Way" Lighting

A RECENT analysis by the Lowell (Mass.) Electric Light Corporation of the cost of operating a "White-Way" street-lighting system containing 391 600-cp. incandescent lamps to be substituted for 391 magnetic arcs resulted in a total annual outlay of $102.84 per lamp on a basis of 3,942 hours' operation per year. The alloca-

Table I—Summary of Investment and Operating Expenses for "White-Way" Lighting

Using 600-Cp. Incandescents ("Novalux")

Total Investment per Lamp		
Lamp, pole conductors, constant-current transformers, lateral ducts and services to lamp standards (Table II)	$289.39	
Main line ducts used for this street lighting (Table III)	44.72	
Mean value of generating station based on capacity of lamp (Table IX)	66.51	$400.62
Fixed Charges Based on Investment		
Interest, 8 per cent	32.05	
Obsolescence and depreciation, including maintenance on all items of investment except generating station and street lighting fixtures	20.03	
Taxes, 4.02 per cent	16.10	68.18
Interest on Working Capital		
Interest on outstanding street light revenue (Table IV)	.68	
Interest on investment in fuel (Table VII)	.21	
Interest on investment in street-lighting supplies (Table IV)	.30	1.19
Operating Expenses		
1,577 kw.-hr. at 8 mills (Table V)	12.62	
Bulbs, 2.92 at $1.83	5.34	
Globes, renewal (Table VI)	1.52	
Globes, washing (Table VI)	0.42	
Patrolling (Table VI)	0.98	
Maintenance (Table V)	1.96	
Supervision and general office (Table VIII)	10.63	33.47
Total		$102.84

Table II—Investment in "White-Way" System

Based on Substituting 600-Cp. "Novalux" Lamps for Magnetites

Investment in lamps, poles, ducts (lateral), conductors, services and rectifier sets for existing magnetite system	$112,119.39
Add:	
Installed cost of new equipment	19,411.17
Total investment	$131,530.56
Deduct:	
Amount company estimates it should be reimbursed by the city in making the change from magnetites to "Novalux" incandescents	18,379.01
Investment to be used as basis to determine rate for new lamps	$113,151.55
Investment per lamp for each of the 391 lamps	289.39

Table III—Underground Main Duct Investment to Serve "White-Way" Street Lighting

Using 600-Cp. Incandescents

Investment in underground duct system 12/31/27	$440,335.31
Number of duct-feet of conduit installed, duct-feet	600,661
Average cost per duct-foot installed	$0.733
Main line duct used in magnetite system, feet	23,856
Value of main line duct magnetite system	$17,486.45
Investment in underground main duct per lamp	$44.72

Table IV—Interest on Outstanding Street Lighting Revenue

	Monthly Bill	Interest One Year at 8 per Cent
White-Way lamps, all night, per lamp	$8.57	$0.68
Investment in Supplies Applicable to White-Way Lights:		
Bases	$135.59	
Columns	470.85	
Globes	139.60	
Canopies	89.24	
Casings	76.50	
Seats and rings	67.81	
Lower globe seats	57.63	$1,037.22
Investment in pole supplies for each of 391 lamps		$2.65
Applicable to All "Novalux" Lights:		
Lamps	$915.00	
Units	557.48	$1,472.48
Investment per lamp for each of 1,412 "Novalux" on system		$1.04
Total investment per lamp in supplies for "Novalux" lamp on ornamental standard		3.69
Interest at 8 per cent		0.30

Table V—Kilowatt-Hours Used by 600-Cp. Lights

	Watts	Hours Operated	Kilowatt-Hours
600 cp. all night	400	3,942	1,577
Life of 600-cp. lamps:			
Normal life by manufacturer's schedule			1,350 hours
Maintenance charges, 600-cp. "White-Way" lights:			
Painting ornamental poles			$0.18
Repair parts and labor			1.78
			$1.96

Table VI—"White-Way" Globes

Estimated to replace globes once every 4.6 years at a cost of $6.98 per globe, per lamp per year	$1.52
Globes are washed once a year—estimated two men two weeks with truck, $166.01 per light	0.42
Patrolling:	
Determined by time of man and truck one hour each day at $1.057 per hour, 365 × $1.057 =	$385.80
Per light $385.80 divided by 391 =	0.98

Table VII—Interest on Working Capital; Interest on Investment in Fuel

Average value of coal on hand	$76,374.32
Total kilowatt-hours used for street lighting, Lowell	2,394,350
Total kilowatt-hours generated, 1927	46,756,214
Per cent street lighting to total generated	5.12
Investment in fuel, the interest charges on which should be charged to street lights $76,374.32 × 5.12 per cent =	$3,910.37
Note: Average inventory value over two years.	
Interest to be added to cost of street lights $3,910.37 × 8 per cent =	$312.83

Interest to be distributed as follows:

	Kilowatt-Hours Used	Per Cent of Total	Total Interest	No. Lights	Per Light
"Novalux"	1,592,568	....	.....	...	.....
Incandescent	185,254	....	.....	...	.....
"White-Way" all night	616,528	25.7	80.40	391	0.21
	2,394,350	....	.....	...	.....

Table VIII—Supervision and General Office Expenses, 1927

Transmission and distribution superintendence	$31,829.49
New-business salaries (one-half)	30,417.21
New-business supplies and expenses (one-half)	1,441.18
General and miscellaneous	177,060.45
	$240,748.33
Total revenue	$1,746,479.33
Revenue for Lowell street lighting	126,058.25
Per cent of total revenue	7.22
Supervision applicable to Lowell street lighting	17,382.03

	Total Revenue	Per Cent of Total	Amount for Each Type	No. Lamps	Per Lamp	75 Per Cent of Charge
'Novalux"	$70,700.00	....	.....	...	.....	.....
Incandescent	15,183.00	....	.....	...	.....	.....
"White-Way" all night	40,175.25	31.9	5,544.86	391	14.18	10.63
	$126,058.25					

Table IX—Investment per Kilowatt and per Lamp in Generating Station

Total investment in generating plant	$4,109,449.35
Present maximum demand on station, kilowatts	16,600
Value of generating plant per kilowatt of demand	$247.56
Demand which may be attained before further extension is made other than boiler addition, kilowatts	27,000
Investment in plant after boiler addition	$4,359,449.35
Value of generating plant per kilowatt of demand after boiler extension is made	$161.46
Average value of generating plant per kilowatt of demand before any extensions are necessary	$204.51
Maximum demand peak, kilowatts	16,600
Estimated sum of peaks (light, power, street lighting); kilowatts	20,400
Maximum peak to reach possible demand of sum of peaks, per cent.	81.3
Mean value of generating plant per kilowatt	$166.27
Kilowatt demand of 600-cp. lamp	0.4
Investment in generating station per lamp	$66.51

tion of investment charges and operating expenses involved in this computation is given in the accompanying tables, headed by the summary of results attained. The Massachusetts Department of Public Utilities is to adjudicate a contract in connection with which the company introduced this exhibit to support its contention that it should receive $98 per year per 600-cp. "Novalux" lamp used in this service. The city has attacked the exhibit as too high.

Engineering Files Made Available to Full Staff

THE use of a centralized card catalog in the engineering offices of the Detroit Edison Company permits ready reference to filed engineering material by any member of the staff with minimum delay and has greatly simplified the classification of data. The system used by the Detroit Edison Company and described in a recent number of the *Synchroscope* by Mary Giblin involves the use of the Dewey decimal system, universally used in public libraries for the classification of books, together with a Cutter number for special topics.

For example, 621.195 is the class for superheaters, but there may be correspondence on superheaters in general or for any one of the various plants of the company or concerning superheaters outside of the company. Additions to the Dewey number of A-1, A-2, M-2 or a similar notation permit the identification of different pieces of material on the same subject. All data may be classified according to this scheme regardless of its nature.

A centralized card catalog of all material classified is kept in the office of the classifier which indexes every piece of material and shows its location. Each department is also provided with a card catalog which indexes only the material in the files of that department. The centralized catalog permits the interdepartment use of material and it also obviates the necessity of each department retaining data which are not essentially valuable to it.

Kw.-Hr. Sales vs. Load Factor

Water heater developed for load-factor business. Split units with low-wattage feature advocated as a result of field tests. Developments and experiences

By GEORGE S. WILLIAMS
Vice-President and General Manager
Central Maine Power Company

I HAVE become thoroughly convinced that the heating of water by electricity for domestic purposes is one of the most profitable businesses for our company to develop. Yet it is a load-building opportunity that has been neglected and received little attention until recently.

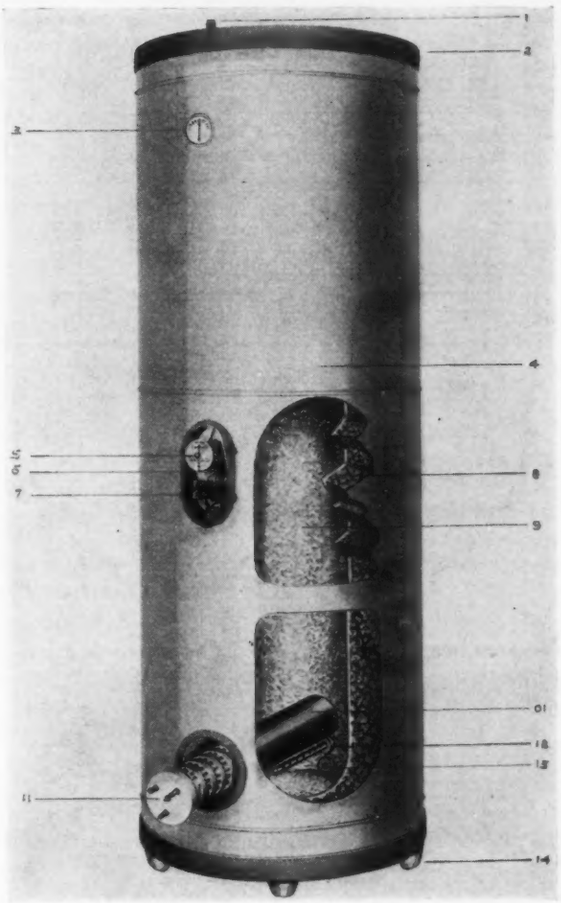
In order for me to explain to you how I, personally, happened to be thoroughly sold on this proposition I will go back a period of two years, when I installed a Swiss heater with off-peak, 6 p.m. until 6 a.m., time-and-temperature control, 2,000-watt unit, in my own home and after operating it for about eight months I found it was necessary to carry the temperature to at least 180 deg., which was excessive for the galvanized iron tank construction, with the result that I got rusty water.

I then tried a heater made in this country with a capacity of 40 gal. equipped with a 2,000-watt heating unit, and I found that with the average use of 40 gal. of water a day the boiler was not large enough to take care of the average family. I next tried another make of heater with a 2,000-watt unit, operated off-peak. Because of the particular construction of the tank of this appliance there was always plenty of hot water available up to 3 gal. of draw-off, but when large quantities of water were used the temperature in the tank dropped very rapidly.

OFF-PEAK OPERATION UNNECESSARY

Then I began to wonder why it was necessary to operate a water heater on off-peak, requiring an expensive time switch and load-limiting devices, when by the use of a smaller heating unit the load could be distributed over the 24-hour period. In other words, this would improve the load factor and at the same time reduce the cost of installation and operation. This would come about by having the unit well insulated, of sufficient tank capacity to take care of the average family and by having a heating unit of a size that would come within the restrictions of the National Electrical Code, whereby it might be connected two-wire, 110 volts. For this service I believe it was necessary to produce a split-heating unit, so that part of the unit could be on continuously and the balance of the unit take care of the peaks.

I also believed the heater should be located where it was easily accessible in case of trouble and where either the unit or the thermostat could be changed without drawing the water out of the boiler. Immediately after these suggestions were made an American water heater manufacturer built one of these boilers according to our own ideas, feeling that there would be a great demand in many localities for a unit of such a simple type of construction.



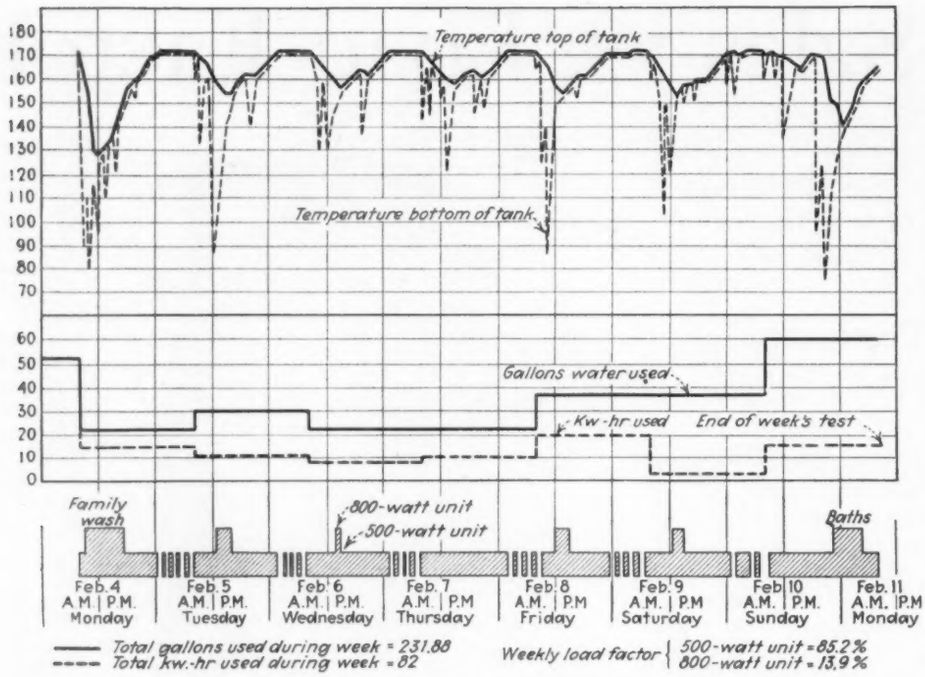
Construction of water heater used for 110-volt, 1,500-watt service

1—Conduit, ready for electric service connection.
2—Steel metal cover.
3—Indicating thermometer.
4—Steel, duco enamel jacket, covering cork insulation.
5—Bourdon tube thermostat (removable without drawing tank, may be adjusted to any desired temperature).
6—Dial of thermostat with variations from 80 deg. to 200 deg.
7—Busbar, with colored wires for connection (no blueprint required).
8—Four-inch granulated cork insulation.
9—Copper or galvanized tank.
10—Brass shell, part of tank, covering heating unit.
11—Removable heating unit.
12—Cold water inlet pipe. (Hot water is at top, on back, combined with "by-pass" of water-waste-preventing mechanism.)
13—Drain pipe.
14—Metal legs.

There is nothing that I can think of that a customer can derive more comfort and benefit from than 50 gal. of hot water on hand in the home 24 hours per day. The device requires simple wiring, operates on 110 volts, two-wire and has automatic thermostat control. With an average consumption of 40 gal. of hot water per day, it brings about an average use of approximately 12 kw.-hr. per day or 360 kw.-hr. per month. At 1½ cents per kilowatt-hour this amounts to $5.40 per month for the average family.

Now, immediately you say, "How does this heater differ from the 3-, 4- and 5-kw. side-arm heater that we have been merchandising?" In the first place, all of these

**As discussed by Mr. Williams at a recent sales conference of the Central Maine Power Company, Augusta, Me.*


Temperature top of tank
Temperature bottom of tank
Gallons water used
Kw.-hr used
End of week's test
Family wash
800-watt unit
500-watt unit
Baths
Feb. 4 A.M. | P.M. Monday
Feb. 5 A.M. | P.M. Tuesday
Feb. 6 A.M. | P.M. Wednesday
Feb. 7 A.M. | P.M. Thursday
Feb. 8 A.M. | P.M. Friday
Feb. 9 A.M. | P.M. Saturday
Feb. 10 A.M. | P.M. Sunday
Feb. 11 A.M. | P.M. Monday
Total gallons used during week = 231.88
Total kw.-hr used during week = 82
Weekly load factor { 500-watt unit = 85.2%
800-watt unit = 13.9%

Seven-day operation of 50-gal., 1,300-watt water heater (standardized)

side-arm heaters require 110/220-volt, three-wire service and an expensive wiring installation. Some of the tanks are not properly insulated, so that the customer often leaves hot water in the tank, which cools off and increases the cost of hot water per gallon used.

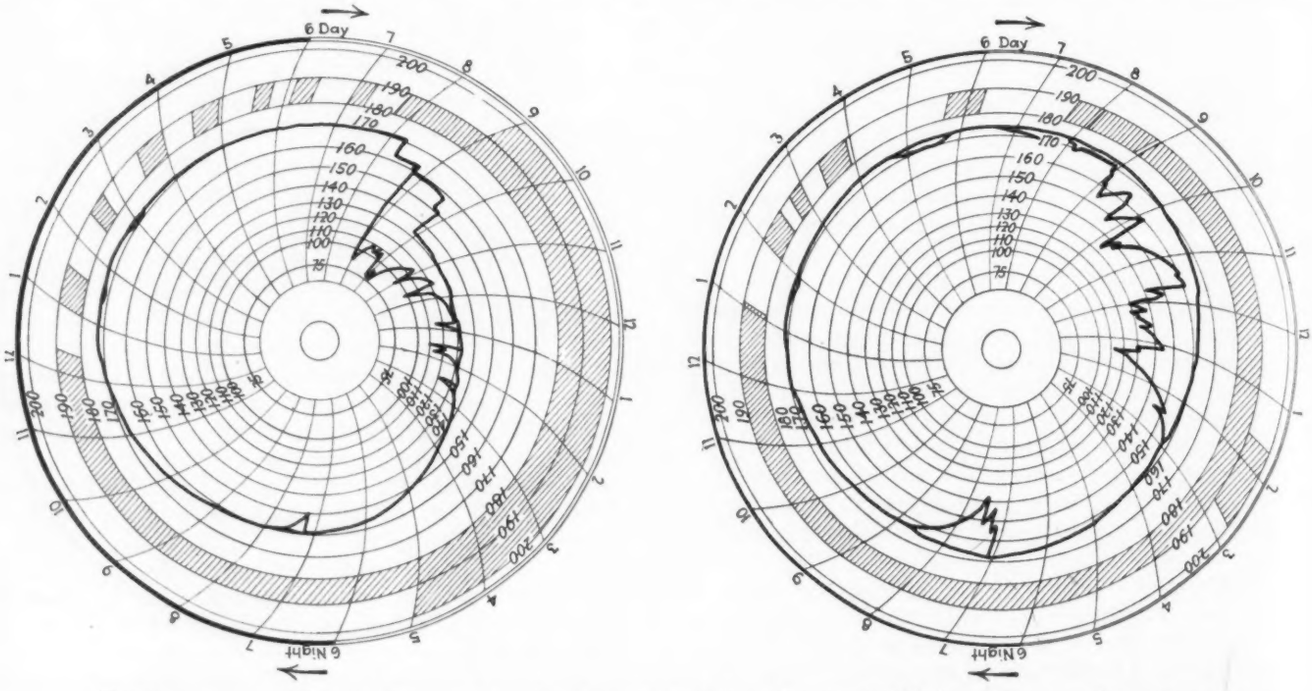
Then think about the cost to the company of providing proper plant equipment to carry this load. You will find that the family begins to use hot water in the morning and keeps it up at certain periods of the day, so that often the 3- to 5-kw. water-heating units are operating directly at the time of the peak load, which means that these units operate at a time when generators are supposed to be working at their maximum capacity. You can follow this through from the station, through the transmission lines, distribution lines and transformers and visualize how you are loading up your plant equipment with peak-load devices. It also is necessary, in order for the customer to use the heaters at all to advantage, to grant him a lower rate than you would give to a power customer, who may be operating at 40 to 50 per cent load factor.

Load-Factor Basis Best

We have gone at this merchandising of hot water heating purely on a load-factor basis so as to offer the customer the lowest possible rate.

You will see from the accompanying chart that the latest heater that I have been operating in my own home has a split-heating unit of 1,300 watts, 800 on one side and 500 on the other. It will be evident that the 500-watt unit operates practically continuously throughout the 24 hours, while the 800-watt unit only comes on during the peaks or when large quantities of water are drawn. This heater will give a load factor of between 65 and 70 per cent, which means that current is being sold at night for storing up hot water for use during the daytime. The generating capacity would be underloaded if not used for this purpose, whereas the 3- to 5-kw. water heater creates a power demand on the system at a time when the system is operating at its highest demand.

We have gone at the entire water-heating proposition



Performance charts for water heater tested by Central Maine Power Company

Charts are for two days of 22.44 gal. use each, but with 15 and 8.2 kw.-hr. consumption respectively

on a load-factor basis. In some cases, no doubt, we can use 1,300 watts, but we are planning to standardize on 1,500-watt units, split 500 and 1,000. We may run into isolated cases where it will be necessary for us to take out this 1,500-watt unit and install one of 2,000 watts. This does not mean that it will be necessary to change the size of the boiler, but it may require a few changes in the wiring.

Increased Use per Customer

Now you can readily see what is going to happen in the energy use per year per residential customer. Our company average was 347 for 1928. It is difficult to get any information for 1928 from other companies so close after the first of the year, but I find that for 1927 we have figures throughout different sections of the United States ranging from 1,413 kw.-hr. per year per customer down to under 200. Some typical data are as follows: Niagara Falls, 1,413; Seattle, Wash., 1,286; Norwalk, Conn., 510; Hartford, Conn., 540; Springfield, Mass., 373; Richmond, Va., 410; Atlanta, Ga., 411; Birmingham, Ala., 357.

It will be noted that there is a wide variation in the kilowatt-hours used per residential customer in these cities. Here in Maine we have cheap hydro-electric power which, if used, involves reasonable load factor conditions and can be sold at a very low price.

Just stop and reason what the consumption of a water heater will do for the residential average. A range will average from 180 to 200 kw.-hr. per month, or 2,160 kw.-hr. per year. A hot water heater will use an average of 360 kw.-hr. per month, or 4,320 kw.-hr. per year. The range will not operate at over 15 or 20 per cent load factor, while the hot water heater, following along the low-wattage feature, will distribute the load over 75 per cent of the 24-hour period, or 75 per cent load factor. I do not mean to deprecate the value of ranges as load builders, but I do wish to show the possibilities of the water heater or of the water heater and range in conjunction.

Water heating has been approached in the past from entirely the wrong angle. I think any division manager or superintendent here will say that he has had many complaints and much dissatisfaction among his customers from the cost of heating water electrically under our past methods of installation. Now we believe that with the low-wattage feature and improved load factor we have found something that we can conscientiously offer to our customers.

Automatic Core Baking with Electric Heat

AN AUTOMATIC, electrically heated oven for the baking of small cores used in the manufacture of iron faucets or spigots for steel barrels has been used by the Steel Drum Accessories Corporation of Buffalo, N. Y., for more than a year. According to a statement appearing in a recent number of *Power Events*, the publication of the Buffalo, Niagara & Eastern Power Corporation, this installation has not only proved entirely satisfactory but has more than paid for itself during the first six or seven months of operation in saving of time and the elimination of labor and has also proved that with the use of electric heat waste is almost negligible.

Cores are placed in trays which are rolled into the oven by an electrically controlled overhead trolley or conveyor system. The oven heat is brought to a temperature of from 450 to 550 deg. F. and is controlled by a thermostat. The air in the furnace is recirculated by the aid of an electric fan and the volume may be regulated.

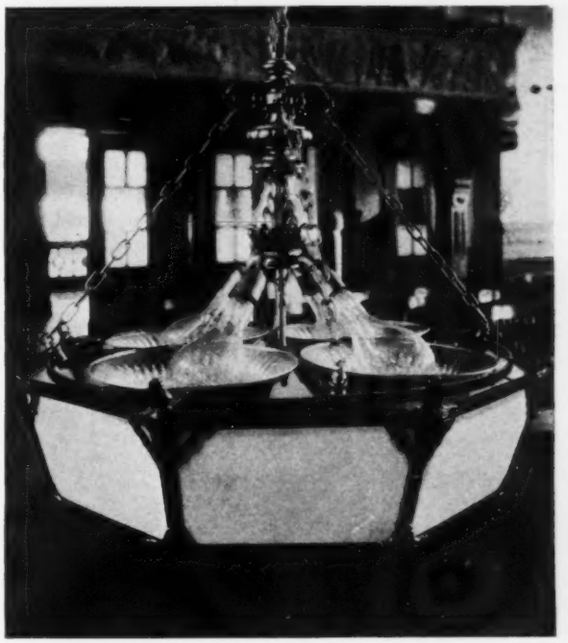
This oven is in operation every day and about 50 to 70 per cent of its capacity is used during the night. It is entirely automatic and requires only the services of a night watchman to note the time for changing the trays of baked cores for those to be baked.

"Application of electricity in the manufacture of our products is 100 per cent efficient and is entirely satisfactory," says A. W. Ogden, president of the Steel Drum Accessories Corporation. "We have forgotten all about the heat regulation of our oven. It takes care of itself."

Lighting an Auditorium for Study Hall Use

By Willard Allphin
Lighting Engineer Fall River (Mass.) Electric Light Company

TO ENABLE the auditorium of the Fall River High School to be utilized as a study room it became necessary to provide an average intensity of illumination of 8 ft.-candles on the desks. The original lighting was provided by three large semi-indirect bowls. It was not



Fixture rebuilt for four 1,000-watt units

desirable to add more fixtures because of the ceiling design. Therefore the required intensity was obtained by rebuilding each fixture to hold four 1,000-watt silvered glass reflector units. The reflector used was of the type having an opal glass cup in the bottom, which serves to illuminate the bowl interior. The resulting illumination varies less than 1 ft.-candle throughout. Because the lighting company was able to show the city a saving in preserving the original appearance of the room the city increased the wattages of all the classrooms one-third. The room is 117 ft. long, 53 ft. wide and has a 35-ft. ceiling.

When and Where Is Daylight Economical?

By M. Luckiesh
National Lamp Works, Nela Park, Cleveland

THE development of artificial lighting would receive a great impetus if light users suddenly became as oblivious of the cost of artificial lighting as they are of the cost of natural lighting. Such a condition cannot be brought about suddenly, but matters can be improved by comparing the costs of natural and artificial lighting. This is one of the primary aims of a systematic study of the cost of daylight.

From an exhaustive analysis of the cost of lighting industrial buildings there is presented herewith a summary of one feature. An eight-hour work period in the daytime and average weather conditions were assumed. Artificial light was considered to be used only when the minimum intensity of natural lighting fell below 13 foot-candles. Electrical energy was assumed to cost 2 cents per kilowatt-hour. The chief factors of natural lighting were considered to be installation and operating costs of glass areas, light courts and extra heating equipment.

The initial costs of the natural and supplementary artificial lighting equipment per 100 sq.ft. of floor area for various single-story industrial buildings were found, for the eight-hour daytime work period and average weather conditions, to be as follows:

	Natural	Artificial	Total
Windowless building	$0	$13	$13
Windows in walls only	29	13	42
Windows in walls and monitor	50	13	63
Windows in walls and V monitor	62	13	75
Windows in walls and sawtooth roof	80	13	93

The annual operating costs of the natural and supplementary artificial lighting per 100 sq.ft. of floor area in each of the single-story buildings for the eight-hour daytime work period were found to be as follows:

	Natural	Artificial	Total
Windowless building	$0.00	$12.77	$12.77
Windows in walls only	5.83	5.35	11.18
Windows in walls and monitor	10.18	4.08	14.26
Windows in walls and V monitor	12.16	3.50	15.66
Windows in walls and sawtooth roof	14.13	3.49	17.62

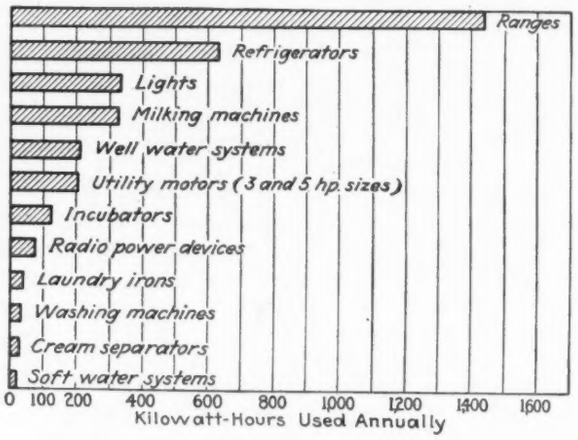
It is emphasized that, with the exception of the windowless building, artificial lighting was assumed to be confined solely to the hours when daylight was inadequate to provide a minimum intensity of 13 foot-candles. Therefore, when the total lighting cost for the eight-hour daytime shift in these single-story buildings exceeds $12.77 per year per 100 sq.ft. of floor area the installation of daylight equipment increases the total cost of lighting beyond that of artificial lighting for the entire eight-hour period under the conditions assumed.

One tendency of civilization is to construct an artificial world independent, in so far as possible, of the whims of nature. As a consequence, mankind came indoors and in doing so natural daylight had to be brought indoors. For countless centuries of meager artificial light daylight continued to provide utilitarian lighting for the indoor work-world. Only in recent years has artificial light been controllable and available in as high intensities of illumination as daylight indoors. With the decreasing cost of artificial light and the increasing controllability, a stage has been reached where they should be compared in every way.

In our complex civilization artificial lighting installations are almost universally necessary to supplement and even to substitute for natural light indoors. Doubtless daylight is desirable when and where it is justifiable. In many cases windows are desired to "let vision out" as well as to "let light in." However, habits are apt to obscure the arrival and the advantage of new means and methods. Many present practices in natural lighting indicate that mankind is in need of treatment for the "daylight habit"—not for the purpose of eliminating daylight, excepting where this is desirable in certain cases, but for the purpose of establishing the proper balance between natural and artificial lighting which economics and good lighting dictate.

Farm Uses of Electricity

TWELVE outstanding applications of electricity used on eleven co-operative farms in Iowa have been carefully analyzed. Many other devices were used, but none contributed to the saving of labor on the farm



How electricity is used on Iowa farms

as much as the twelve items listed. The farmer ordinarily selects his equipment in the order that it is most useful and serviceable to him. The accompanying table reports the total value of electrical equipment on these eleven farms along with the annual energy consumption of each farm for the year 1927. There were 33 lighting outlets per farm, the value of which, as well as the installation cost of equipment, is not included in the approximate total value of equipment per farm.

Equipment Value and Energy Consumption of Eleven Iowa Project Farms

Farm No.	Approximate Value of Equipment at Retail Prices	Monthly Average Energy Consumption, Year, 1927, Kw.-Hr.	Energy Consumptio, Year, 1927, Kw.-Hrn.
1	$790	137	1,644
2	1,054	125	1,500
3	961	118	1,416
4	1,168	357	4,284
5	1,679	285	3,420
6	1,059	115	1,380
7	1,584	296	3,552
8	1,841	372	4,464
9	1,692	453	5,436
10	867	246	2,952
11	994	152	1,824
Average	$1,244	241	2,897

European Metering Practice

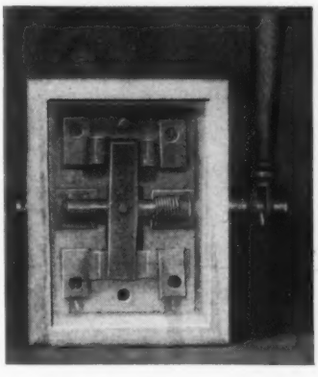
Multiple-rate meters largely used on account of diversification of schedules. Absence of standardization of frequency and voltage is an added complication of meter practice. Large use of demand instruments

By J. C. LANGDELL
Allied Power & Light Corporation, Jackson, Mich.

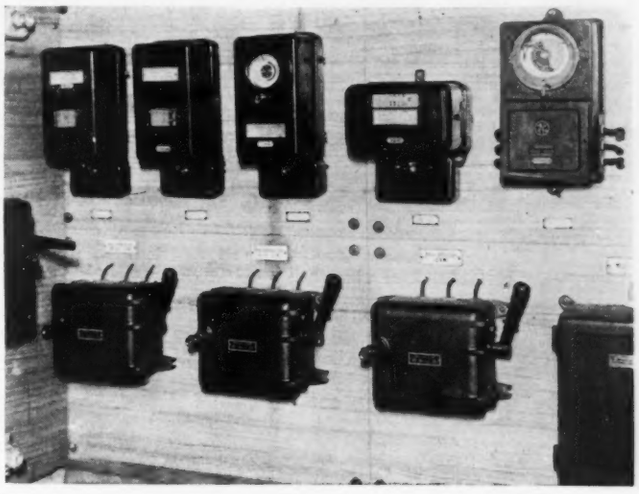
IN TWO previous articles* entitled "Foreign Progress in Raising Load Factor" and "Electric Water Heating in Europe" the domestic and commercial utilization of off-peak energy for water and air heating in some European countries, notably Switzerland, was discussed. The development of these classes of load to proportions quite remarkable to the American observer has been made possible by rate structures and schedules that take detailed cognizance of variations of load and generating conditions. It follows, therefore, that, in our eyes, European meter practice is complicated and involved. A survey of system load curves from many European cities would seem to furnish evidence that improvement of load factor justifies this complexity and elaborateness of metering requirements. Two- and three-rate meters are common; seven-rate meters are used in some countries. Sometimes a maximum demand record is taken on one rate.

Installation practice varies greatly. In some countries main line switches are required, while in others it is permissible to install only main line fuses of the plug type, which often are used up to 60 amp. The practice of one of the largest companies in Paris is to install the meter on a wooden board, together with a cutout switch ahead of the meter and the fuses, the switch and fuse box being inclosed in a small wooden box with a glass front of very primitive construction.

In apartment houses a main line switch is usually provided in the hallway for every apartment. Meters, as well as the boxes containing the cutout switch and fuses, are sealed. The main line switch for controlling several apartments is usually mounted in a common hallway in a cast-iron box and locked. In Paris meters are not tested on customers' premises, but are removed for periodic test to the meter laboratory of the company. The operation of two- and three-rate meters is controlled by time switches, usually furnished by the company. These time switches are electrically wound and from available information they are giving excellent service. It is stated that the Compagnie Parisienne de Distribution D'Electricité has been considering the possibility of introducing a superimposed frequency of approximately 500 cycles, for the purpose of operating the dials on the three-rate meters at stated intervals during the day. This would do away with time switches and would undoubtedly result in great savings both in installation costs and maintenance, though it is the belief of the writer that the results up to date have not been at all satisfactory. The writer investigated this problem on returning to the United States and was advised by several of the manufacturers that this frequency could be superimposed, providing 1 per cent of the total capacity would be installed to take care of the necessary charging current.



Type of entrance switch used in Paris



Typical installation of two-rate meters and time switch

LOAD BUILDING AFFECTS METERS

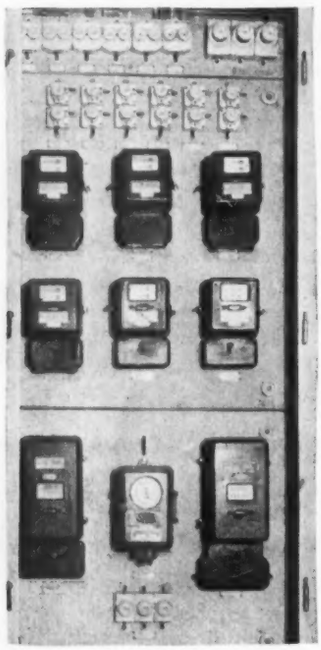
Switzerland was one of the first countries abroad to investigate and study the question of filling in the valley in the load curve and today a great number of the other countries in Europe are following in that country's footsteps and are adopting special time rates which require two- and three-rate meters. The adoption of such rate schedules results always in the increased use of energy during off-peak hours for purposes for which electricity was formerly considered too expensive, and a decided improvement of the load factor is usually obtained immediately. The city of Basle in Switzerland has in this way raised its load factor to 70 per cent.

Paris has always had a very poor load factor. The lighting load creates a tremendous peak, while the day load, due to lack of industries, is very small. The load factor has been as low as 22 per cent. Several thousand three-rate meters have been installed in Paris during 1927 since the taking effect of the three-rate schedule.

One of the most modern meter departments in Europe is in the Electric Company of Strassbourg, an organiza-

February 2 and 9, 1929, issues of the ELECTRICAL WORLD.

tion which can be compared favorably in every respect with any of the large utility organizations here in the United States. Here meters are periodically tested on the customers' premises. Also, the two- and three-rate solution is practised in order to eliminate the valleys in the load curve. Strassbourg has been thoroughly investigating this problem, however, much longer than Paris and has had greater success in its solution. Hot water storage tanks mainly and also house heating are some of the loads that created an increased consumption during off-peak hours.



Typical meter and switch panel installation

Metering conditions in Switzerland were found to be better than in other European countries. Meter departments everywhere are up to date and well organized, while the metering in itself is in most instances more developed in certain details than in the United States. The use of appliances such as vacuum cleaners, washing machines, toasters, fans, stoves, and many others, is general in the Swiss household, while hot water is heated at night and stored in tanks for use the following day. House heating is done electrically by storage heaters which are on during the night and give up their heat without current during the daytime.

There are 900,000 metered customers in Switzerland in addition to 250,000 flat rate customers. The flat rate is applied, however, only in connection with bell transformers and intermittent, short-duration hall lighting loads which do not exceed 10 watts. Normal 5- and 10-amp. meters are used for lighting customers without heating apparatus, or only very small heaters, flat irons or fans. Two-rate meters with clock or hand control are used, especially in towns or districts with large consumptions for lighting. Double price meters with subdivided series coils are used on a very large scale in the country by customers with small heating apparatus (generally not above 10 amp.). Several companies use these meters combined with two-rate dials.

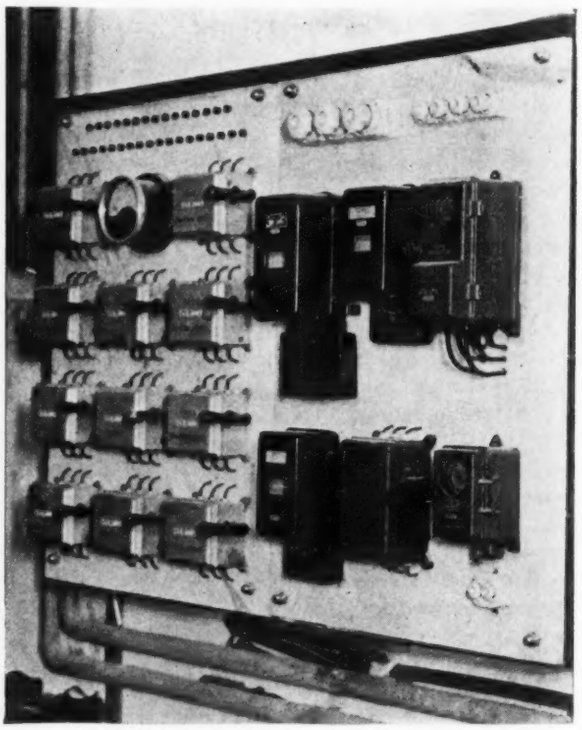
Three-rate meters are employed for customers with large heating loads for charging storage batteries and for electric baking, etc. Combinations of two-rate and three-rate meters, with or without time limiters, are also used, for example: Light and small heating apparatus, fans, vacuum cleaners and 5.3-gal. water heaters for kitchens, etc., on two-rate meters; large heating devices on three-rate meters; 53-gal. heaters with a 500-watt element on a low flat rate, but cut out for the lighting period by time limiters; a large heating element, say of 1 kw. to 2 kw. with hand switch, is put on a three-rate meter. All meters and time limiters are connected to one centrally located contact clock. In houses with several apartments all meters and time switches are controlled by the same clock.

A maximum demand rate is generally used for large customers, such as factories or communities and corporations buying energy on a large scale. Besides the simple maximum rate, several varieties are in use; i.e., maximum with limited registration only during the lighting period, and maximum with two-rate or three-rate. There are also employed maximum demand meters with a contact device on the demand scale and with a two-rate dial register, which functions to the effect that if the contact is closed before the end of a demand interval the energy consumed is then registered on the upper (high rate) dial. In certain localities maximum demand meters are used for all customers above 1 kw. Differential meters are used in special cases.

Reactive component meters in series with the normal watt-hour meters are in general use for large power customers. A common rate employed in connection with these meters is as follows: Increases of energy price of 2 per cent for each per cent of power factor below 80 per cent. In certain cases a credit of 1 per cent is allowed for each per cent of power factor above 80 per cent.

It may also be mentioned that maximum or two-rate meters are combined with Sunday attachment clocks. This attachment to the clocks will cut out automatically the high rate or maximum pointer or both on Saturday and Sunday.

For small house service no service entrance boxes are used. The meters for this purpose are mounted on a



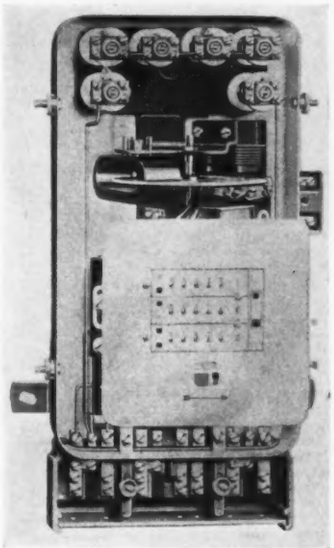
Meter and switch for controlling an oven installation

panel of marble or "eternité" which generally holds the main and line fuses. The main fuses are usually sealed. It is the custom to put the meter panels in a place where they can be read and inspected without making it necessary to enter the rooms of the consumer. For larger house service and industrial customers entrance cabinets containing cutouts and fuses are employed. The wires are usually placed in tubes or pipes. The Bergman tube is generally used for this purpose. This kind of tube

consists of impregnated paper protected on the outside by a galvanized sheet iron covering. Steel tubes, at times, also find application.

With large customers it happens very frequently that the voltage for lighting and power are different, while the combined maximum demand for both has to be determined. Here, then, five system meters with maximum demand indicators are used.

With very large consumers it is customary to have two installations, one belonging to the central station, the other to the consumer, one checking the other. The meters are generally read once a month. Many central stations let the man who reads the meter present the bill at the same time and collect the charges covering the consumption of the preceding month.



European three-rate meter

In Holland, especially in Amsterdam, there is extensive use of prepayment meters. Amsterdam, during the last few years, has put into service more than 100,000 prepayment meters. These prepayment meters in many cases are furnished with a device which will automatically average the delivery of energy on a step-down basis, namely, for a first certain quantity or block of kilowatt-hours consumed the coin inserted into the meter will deliver a certain quantity of kilowatt-hours. After this first block has been consumed the meter automatically will deliver against the inserted coin a large number of kilowatt-hours.

London Offers Special Problem

In London, England, the use of electricity is by far not so popular as in the United States or in some of the continental countries of Europe. Gas competition is tremendous and the government regulation requiring all underground lines makes the expansion of the distribution systems of the central stations very difficult. The size of the lighting companies is generally very small. Of the four companies in London the largest at present has only 75,000 meters and second largest only 50,000 meters, while London in population and size exceeds New York City. In London there are in use at present frequencies of 40, 50, 60 and 83 cycles, while two years ago also 93 and 100 cycles were employed. The voltages used are just as non-uniform. Voltages of 100, 102, 105, 110, 150, 200, 205, 210, 220, 230, 240 and 250 are employed.

The most interesting and valuable point observed in Europe was the very satisfactory solution and application in Switzerland of the two- and also three-rate tariffs. The lack of standardization of service is very apparent in European meter practice and this, combined with the complicated rate structures, presents very many interesting problems to the meter department. For much of the information contained in this and the two preceding articles the author acknowledges his indebtedness to E. O. Meyer, general manager Strassbourg Electric Company, Strassbourg, France, and to Otto Maag, Landis & Gyr, Zug, Switzerland.

Dairy Farmers Need Electricity for Milk Cooling

By E. C. Easter

Chief Agricultural Engineer Alabama Power Company

THE development and use of electric refrigeration is progressing more rapidly with dairy than with other type farms, due to the absolute necessity of cooling and storing the milk. This requires comparatively large amounts of refrigeration in some form. Thirty dairymen served from the Alabama Power Company's rural lines have installed refrigerating machines that use an average of approximately 8,500 kw.-hr. a year, a total annual consumption of about 255,000 kw.-hr. The total connected load is approximately 75 hp. Prior to the installation of refrigerating machines these dairymen were each using an average of about 650 lb. of ice per day, at an average price of 40 cents per 100 lb.

In addition to the elimination of handling ice, the refrigerating machines are resulting in better refrigeration at a greatly reduced cost. These 30 dairymen are saving a total of about $15,000 per year, when their former cost for ice is compared with the present cost of electric power, plus interest and depreciation on the refrigerating equipment. However, a part of the saving results from increased efficiency in the refrigerating system. Many dairymen who use ice have poor cold storage boxes and rooms, with little if any insulation, causing great loss of refrigeration. Refrigerating machines are installed by refrigerating engineers and usually the cold storage boxes and rooms are well insulated, which materially increases the over-all efficiency of the plant.

To provide adequate and convenient refrigeration at a dairy it is necessary to consider the entire dairy operation with a view to planning a complete system rather than putting a machine in to replace ice as used at present. The dairyman who delivers milk in bottles to retail customers needs refrigeration for cooling the milk immediately after production to at least 50 deg. F. and preferably to as low as 35 deg. F., to cool the milk bottles from usually about 85 deg. to the desired temperature, dry cold storage for the night's milk, and for making ice to crack over the crated bottles en route to market. In addition, the laborers at the dairy are to be provided with cold water, and the refrigeration losses must be amply provided for. Adequately to take care of this load requires a refrigerating capacity of about 15 lb. of refrigeration per gallon of milk produced per day. For example, a dairy producing 100 gal. of milk per day, especially in the warm Southern climate, requires for complete refrigeration a $\frac{3}{4}$-ton refrigerating machine.

The most satisfactory plan of refrigerating system for the retail dairy consists of the refrigerating machine, a brine tank, separate cold storage room, precooler, a pump and motor for circulating the brine through the precooler, a water cooling tower with pump and motor for circulating the water over the cooling tower. Such

a system provides complete and convenient refrigeration that also adds to the convenience of handling the milk. Some of the smaller dairies, without sufficient quantities of milk to justify a separate cold storage room, are very satisfactorily combining the brine tank and storage facilities in one concrete or wooden box with the brine tank in the center and a dry cold storage compartment on each side.

The energy consumption for complete refrigeration at the retail dairy varies, of course, with different dairies, with different machines and with the different seasons of the year, but averages about 7.0 kw.-hr. a month for each gallon of milk produced daily.

The dairyman who sells milk in wholesale quantities, of course, does not need as great a refrigerating capacity as the retail dairyman. Usually a refrigerating machine with capacity of 7 lb. of refrigeration per gallon of milk produced per day will take care of the wholesale dairy. A good wooden or concrete box with the cooling coils immersed in water or brine provides a satisfactory system for the wholesale dairy. The consumption of electricity for refrigeration at the wholesale dairy averages about 3 kw.-hr. per month for each gallon of milk produced per day, and also results in a reduced cost of refrigeration as compared with the cost of ice prior to the installation of the machine.

One dairy farm near Mobile, Ala., with an electrically operated refrigerator of 3 hp. connected load uses 15,000 kw.-hr. a year, a load factor of about 65 per cent.

Letters from Our Readers

Pole Line Practices

To the Editor of the ELECTRICAL WORLD:

For many years solder has been used as a connecting medium for electrical joints and, no doubt, for a few connections it will continue to be the best, but there are many places where it should be discontinued and a clamp type of connector used for the reasons of saving in labor and the better electrical and mechanical results obtained.

That which is most to be desired in making electrical connections is conductivity and mechanical strength throughout the entire circuit, and as no chain is stronger than its weakest link, so the electrical circuit is no stronger than its weakest part; especially is it weak in many places where soldered connections are used. The conductivity of solder as compared to copper is low, approximately 9 per cent. A soldered connection has no mechanical strength when melted and it costs considerably more to make.

For example, to make a connection with solder between wires and pole-top switches, transformers or other equipment requires two men, a helper on the ground and a man on the pole or other structure. Besides requiring double labor, this connection takes from two to three times as long to make and thus costs much more in labor than does a clamp type of connection.

A soldered joint is no better than the mechanic doing the work, and even the best of mechanics sometimes make a poor soldered connection due to the fact that the units being connected must be held perfectly still while the solder is cooling, which is rather hard to do. If the cooling is hastened by applying a damp cloth to the lug the lead shrinks too quickly and a poor connection is made between the inner wall of the lug and the wire soldered into it. It is almost impossible to inspect a soldered connection and really tell whether it has been properly made or not.

No doubt if a check were made of damage to equipment and interruptions of service in years past, it would be found that many thousands of dollars of damage and many interruptions could be traced to the failure of soldered connections, which would have been avoided if a clamp type, copper-to-copper connection had been used. Furthermore, the abandonment of the use of solder would do away with torches, furnaces, soldering flux, gasoline and gasoline hazards, all of which would make for cheap electrical connections and greatly improve the factor of human safety.

Parallel analyses of solder and copper-to-copper connections would be approximately as follows:

Tools and Material Needed to Make Soldered Connection	**Tools and Material Needed to Make a Clamp Connection**
Solder	Wire cutter
Soldering flux	Knife
Gasoline and container	Wrench
Wire cutter	Sand paper
Knife	Clamp connector
Wrench	On equipment such as knife, switches, transformers, machinery, etc, the manufacturer could furnish the clamp connector instead of the lug with the equipment, so the final requirements of the clamp type of connector would be only tools and labor.
Sand paper	
Gasoline furnace	
Soldering pot and ladle	
Handline	
Soldering pan to catch hot lead	
Blanket to cover equipment underneath where solder joint is being made	
Goggles to protect the eyes	
Increased hazards from a safety first standpoint — hot lead, gasoline and soldering flux	
Labor—Two men—three joints require an average of ten minutes for each joint. If one joint is made, this cost would be increased. If more than three are made, it would be increased somewhat.	Labor—One man—five to eight minutes.

There are clamp connections available for both inside and outside construction; their wider use would be a large improvement over the soldered connection as used in a great part of electrical construction. As stated above there are many places, such as cable, armatures, transformers, potheads and coil connections, where solder is still the best agent, and possibly will remain so, but for almost all other connections on inside and outside electrical construction we should discontinue its use.

J. E. BUSHER,
Superintendent Electric Station Construction Department.
Kansas City Power & Light Company,
Kansas City, Mo.

Dancing Cables

To the Editor of the ELECTRICAL WORLD:

I was much interested in W. K. Archbold's article in the January 26 issue of the ELECTRICAL WORLD regarding dancing cables. This phenomenon is much the same as that which we have occasionally experienced in long tubes used for radiation on transformers. These tubes are about 2½ in. in diameter and of extra heavy pipe and therefore very stiff and rigid when welded at each end to the tank on which they are mounted. No one would think that they could be set in vibration by a steady wind not over 30 miles per hour, but we have repeatedly had them vibrate under these conditions an inch or more in the middle of a tube less than 10 ft. long.

I plan to have some tests carried out and some calculations made to see if the cases you report and those we have experienced can be caused and prevented by the same methods.

WALTER S. MOODY,
Consulting Engineer, Transformer Department.
General Electric Company.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Two Remotely Controlled Automatic Hydro Power Plants in South America.—B. FLECK.—A description of a 125- and a 95-kva., respectively, hydro power plant located in Umtata and Ceres, South Africa. When planning a small hydro power plant the following question must invariably be considered. Is it more appropriate to adopt remote or entirely automatic control? Generally speaking, full automatic control becomes of greater moment as the distance between a control center and the hydro power station increases. If a plant is entirely automatic no pilot lines are needed, thus with longer distances there is a likelihood of achieving a certain saving in spite of the outlay for extra apparatus required. The advantage of a remotely controlled semi-automatic plant is that it adapts itself much more readily to the momentary current demand of the system than an entirely automatic plant whose current supply usually cannot be altered by the switchboard attendant. This advantage could be utilized to the full in the plants concerned, which are medium pressure systems having limited storage facilities.—*A. E. G. Progress*, February, 1929.

The Metropolitan Vickers Self-Contained Turbo-Generator.—A turbo-generator embodying a notable advance on anything in the way of turbo machinery previously available is to be installed in a cotton mill in Woosung. Turbo-generating units have, up to the present, followed a practically standardized layout evolved by the simple process of connecting together the various pieces of apparatus necessary for the operation of the plant. This turbo-generator is a self-contained machine. The turbine and condenser has been combined into one unit and the auxiliaries are mechanically driven from the main shaft, eliminating the necessity for the basement and even for foundations for auxiliaries. The driving of all auxiliaries direct from the set will greatly simplify starting and operating and result in a higher efficiency as well. The set is provided with a special type of governor gear of extreme sensitiveness, giving perfect governing in spite of the small flywheel effect of the rotating parts.—*Far Eastern Review* (*China*), January, 1929.

High-Speed Circuit Breaker.—L. BARBILLION.—For the protection of rotary converters against flashovers on their commutators, in case of short circuits, or for the protection of mercury-arc rectifiers against back fire, a number of very high-speed automatic circuit breakers have been developed in late years. All of the hitherto known designs have utilized either the attraction or the release of a magnetic armature to trip the breaker mechanism. In this very detailed paper the author describes an entirely novel design of such a breaker, in which the opening of the circuit is accomplished electrodynamically by the displacement of a light-weight copper bar in a small gap magnetic field. The upward motion of this bar actuates directly the current-opening contact, causing a double rupture with the ensuing arc quickly quenched in a strong blow field. The device does not, however, break the entire current, but inserts current-limiting resistors in the line, leaving it to a secondary automatic breaker to accomplish the final break. Tests made with the new ultra-rapid breaker indicated its own opening time within ½ to 3,000th of a second. A spring attached to the moving bar makes the breaker always self-closing. Nine oscillograms show the actual performance of the device in railway service.—*Revue Générale de l'Electricité*, February 9, 1929.

Transmission, Substations and Distribution

Proposed Formulas for Conductor Spacings.—WILLIAM T. TAYLOR.—The most important consideration which governs the spacing of overhead electric power conductors is the necessity for preventing them from making contact or flashing over. The lightweight conductors, more particularly in the longer spans, have a relatively greater tendency for equivalent sag and sagging to swing out of the synchronism than the heavier weight conductors of equal diameter. Wind conditions favor the smaller conductor, provided it is relatively heavier, such as copper. The weight of conductor is practically fixed by the choice of material and loading regulations.—*Electrician* (*England*), January 25, 1929.

Tuned Transmission and the Series Capacitor.—C. M. LONGFIELD.—When the transmission of electrical energy over appreciable distances became an accomplished fact and engineers generally appreciated the quantities involved it was apparent that, quite apart from structural limitations, there were definite limitations introduced by purely physical factors which made the economical transmission of power difficult. From the then known phenomena it was seen that increasing loads and increasing distances required higher voltages and higher voltages meant greater attention to insulation. But while insulation design can be based upon known physical properties of certain "insulators," the mere fact of supporting such insulators upon cross-arms may, in some cases, upset the symmetry of the electrostatic field, thus rendering more or less ineffective the careful work of the designer of the insulator. This and a lot more could only be learned by experience. Thus it is natural that the economic distribution of energy would be hindered by factors which are largely bound up with insulation.—*Electrical Engineer* (*Australia*), January 15, 1929.

Units, Measurements and Instruments

A New Method for Obtaining Transient Solutions of Electrical Networks.—W. P. MASON.—A new method of obtaining transient solutions of electrical networks is developed which depends upon the fact that a distortionless line can be made to approach as a limit all three of the circuit elements, resistance, inductance and capacity. The process of solution consists in solving for the current in a distortionless line, which is ordinarily a simple process, and then proceeding to the limiting case of the distortionless line which approaches the element or elements of interest. Some examples are worked out and a derivation of the Laplacian integral solution is given. It is interesting to note that this method gives a formal solution of the Laplacian integral equation.—*Bell System Technical Journal*, January, 1929.

Ground Return Impedance: Underground Wire with Earth Return.—JOHN R. CARSON.—In certain transmission problems, especially those relating to induction and interference phenomena, it is necessary to know the transmission characteristic of the circuit composed of an underground wire with earth return. These can be evaluated by well-known engineering formulas provided the ground return impedance is known. The paper gives the mathematical solution of the problem and shows that the ground return impedance is substantially independent of the depth of the wire below the surface.—*Bell System Technical Journal*, January, 1929.

Illumination

Electric Beacons for Airplanes.—H. WALTER.—Three main features are required for airplane beacons—long-distance visibility, small power consumption and distinctness. Many more factors than the inverse square of distance determine visibility. Atmospheric absorption, fog and rain, elevation angle and color are of great importance. Curve sheets are given for the minimum candlepower required to see a light under different air conditions, elevation angles and height of the airplane above ground. To achieve distinctness with color is not economic, since all filters absorb light. Neon

lamps are being used extensively, but can only be of subordinate importance because they do not lend themselves readily for optical focusing devices. In addition the claimed superior fog-penetrating power of neon lamps has not as yet been proved conclusively. Much more promising results have been obtained from flashing powerful and well-focused white light at regular intervals. Preferably the flashing should be relative to one point of approach; that is, produced by a revolving light. To assure absolute reliability, such beacons are now equipped with three lamps, which are changed automatically as they burn out. For main points of the flying course and a maximum of reach the arc lamp has no superior. Experience factors are given for the most economic time intervals for flash signals.—*Elektrotechnik und Maschinenbau,* February 3, 1929.

Heat Applications and Material Handling

The Electric Furnace for Hardening Steel.—EDMUND L. HILL.—In order to harden steel correctly, it is necessary to heat it to exactly the right temperature to obtain the finest grain, and then permanetly to fix this changed arrangement of the molecules by quenching. The finer the ultimate grain structure the greater will be the toughness, resistance to wear and strength of the hardened steel. The steel before heat treatment consists of a compound of carbon and iron called cementite, set in a matrix of residual iron, known as ferrite, and this has associated with it certain foreign substances known as manganese, sulphur, silicon and phosphorus. When steel is correctly heated the cementite goes completely into solution; i.e., it divides up into very fine particles and distributes itself evenly among the ferrite. The resultant mass has a homogeneous structure and consists of a solid solution to which the name Austenite has been given. This is a true solution, and the only difference between it and a solution of, say, sugar in water, is that the latter is liquid and the former solid. In tempering high-speed steel electric furnaces are widely used with pyrometer and thermocouple control.—*Electrical Engineer (Australia),* January 15, 1929.

Electrically Welded Wheels.—K. REITER.—A special arc-welding machine is described for the manufacture of fabricated steel wheels as a substitute for cast-iron wheels. The hub and the periphery are held together by two disks, which are pressed or spun from sheet steel. Four circular welds and a few spot welds are required and are produced automatically under a stationary electrode and the slowly revolving wheel. A properly arranged magnetic blow field concentrates the arc upon a confined spot. A wheel of 18 in. diameter, designed to carry normally a load of 300 lb., withstood 400 blows with 180 ft.-lb. and did not bend out of shape until loaded with 18,000 lb. Compared with an equivalent wheel of cast iron a saving of 80 per cent in cost and 70 per cent in weight can be realized.—*Elektrotechnik und Maschinenbau,* January 20, 1929.

Electrophysics, Electrochemistry and Batteries

Experimental Methods for Determining the Distribution of Electric and Magnetic Field.—B. HAGUE.—There has been in recent years a continually increasing interest among designers in the accurate determination of the distribution of electric and magnetic fields met with in engineering practice. The enormous development of modern electrical engineering has called into being a large number of problems to which the older methods used for the calculation of electric stresses or for the estimation of magnetic permeance provided the best and adequate solutions. For example, the high voltages used in modern electrical transmission plants have rendered necessary much more refined ways of dealing with the problems of installation, designing generators, transformers, transmission line insulators and cables that have hitherto been required. Again, in theory and design of electromagnetic machinery the importance of an accurate knowledge of the magnetic flux distribution, especially of the leakage field in large modern generators and transformers, cannot be overestimated when it is remembered that the solution of such practical problems as the economical calculation of excitation, the predetermination of reactance and regulation and the computation of short-circuit forces depend upon such knowledge.—*Electrician (England),* February 15, 1929.

Oxide-Coated Radio Valve Filaments.—B. HODGSON.—A review of recent developments outlining present methods of manufacture for commercial purposes and indicating views on the mechanism of electron emission from alkaline oxides. Although some of the earliest valves probably had carbon filaments when valves first came into commercial use it was to the oxide-coated filament that manufacturers turned as the most convenient source of electron emission, which varies according to a definite law.—*Electrical Review (England),* February 15, 1929.

Traction

More Tonnage at Lower Expense Is Result of Electrifying Mine Railroad.—H. A. WALKER.—El Potosi Mining Company's 30-in. gage steam railroad for many years served mines in the Santa Eulalia district, near Chihuahua, Mexico. Increasing operation and maintenance costs plus congestion of traffic over the 15-mile single-track right-of-way from the mines to the smelter and other indirect factors made betterments imperative. In consequence during 1925 the entire main line was changed over to an electrically operated 600-volt d.c. overhead trolley system This is the only industrial narrow-gage electric railway in Mexico, the other installation of any type in the country being that of the Mexican Railways, Limited, which has 70.23 miles of broad-gage roads electrified in southern Mexico.—*Engineering and Mining Journal,* February 23, 1929.

Brown Bovari Locomotives on the Japanese Government Railways.—Electric tramways and suburban railways have been in use in Japan for the last 30 years. The first electric tramway was the one to Kyoto opened in 1895. At the present time there are 3,000 km. of tramways and suburban, interurban and modern railways on which electric traction is used.—*Far Eastern Review (China),* January, 1929.

Miscellaneous

Annual Report 1928.—K. SACHS and P. FABER.—The first issue of this magazine is devoted every year to a general survey of the most outstanding accomplishments in the past twelve months. On 67 pages, illustrated with 107 drawings and photographs, is presented a remarkable record of this Swiss concern, covering the full range of applied electricity. Descriptions of the various items are restricted to but a sentence or two, but the value of such a report is chiefly the study of the illustrations. Of great prominence is the description of the firm's foremost achievement in the design, building and the erection of the 160,000-kw. twin turbo unit for the New York Hell Gate station. Of great economic importance for Switzerland are the very rapid strides toward complete electrification of all main roads. Up to the end of last year 60 per cent of all Swiss railroads, carrying 80 per cent of all Swiss traffic, were electrified, representing a total of 1,000 miles.—*Brown, Boveri Mitteilungen,* January, 1929.

A. D. 1828-*A. D.* 1928: *A Contrast in Mining Methods.*—S. BURNS.—The system of high-voltage distributing networks owned and operated by the Newcastle-upon-Tyne Electric Supply Company and its associated companies embraces the whole of the Northumberland and Durham coalfield. It is interesting alike to those engineers who study the economics of the problems that are presented in the generation and transmission of power supplies for collieries and to those who are more particularly concerned with the benefits likely to be derived where a colliery takes full advantage of the supply afforded. The trend of development is toward intensive machine mining, and as considerable progress along these lines already has been made a contrast of the old with the modern working methods is given by two imaginary tours, one made in 1828 and the other in 1928. Antiquated methods of operation are compared with the modern methods and show imaginary visitors on these tours.—*Mining Electrical Engineer (England),* January, 1929.

News of the Industry

Looking Into California Electrical Bureau

Federal Trade Commission Examines Secretary Regarding Its Publicity Methods and Sources of Revenue—$48,000 Contributed in 1928

HEARINGS on the publicity phase of the public utilities investigation were resumed by the Federal Trade Commission on March 13 when Victor M. Hartley of San Francisco, executive secretary of the California Electrical Bureau, was called to the stand. Mr. Hartley explained that the bureau disseminates instructive information in California alone through broadcasts, pamphlets and advertising matter. Regular news bulletins are not sent out to the papers nor has any matter been sent into the schools excepting data on house wiring and farm electrification when requested. Advertising designed to promote use of electricity has been undertaken on an extensive scale since the members of the bureau have realized the need for state-wide coverage of a nature formerly undertaken locally by individual companies.

Asked by Robert E. Healy, chief counsel for the commission, whether he thought certain published articles had been a result of the bureau's advertising, Mr. Hartley declared that they stood on their own merits and would have appeared, advertisements or no advertisements.

The bureau's membership is composed of four groups, namely, power companies, electrical equipment manufacturers, electrical supply jobbers, and electrical contractors and retailers in California. These have contributed from $12,000 in 1921 to $48,000 in 1928. Power companies have furnished from 65 to 75 per cent of the total.

Mr. Hartley was scheduled to appear again Thursday, after which, as stated last week, A. E. Wishon was to be called.

Trade Commission Files Brief in Bond & Share Case

A brief was filed with the United States District Court in New York on March 9 by the Federal Trade Commission in support of its attempt to make the Electric Bond & Share Company produce certain records and permit the questioning of employees in the public utilities investigation now under way.

The brief contends that the Electric Bond & Share Company is among the classes of corporation which the commission was directed by the Senate to investigate and which the Trade Commission act authorizes it to investigate, inasmuch as the company is engaged in interstate commerce, selling its securities across state lines, acting as publicity agent for scores of operating companies and directing, managing and supervising the business of companies engaged in interstate commerce. Even if the Electric Bond & Share Company is not engaged in interstate commerce, the brief says, the commission has power to investigate its relations to companies that are so engaged. These contentions and others of a supporting nature are stressed, and it is maintained that the books and vouchers sought are relevant to the investigation and that subpœnas issued do not violate the constitutional amendment prohibiting unreasonable searches and seizures.

Coincident with the filing of the brief, Robert E. Healy, chief counsel for the commission, presented a written offer to prove various allegations of its petition for court action. This is in accordance with an agreement reached on February 16 at the first court hearing on the enforcement proceedings. The offer outlines relations of the company with certain subsidiaries in financing and handling of contracts. It covers the documents desired by the commission and takes up other pertinent matters. The court is to decide upon the admissibility of this proof.

Georgia Power Company Plans Big Steam Plant

Plans for one of the largest steam-electric plants in the South have been made public by the Georgia Power Company. This plant, to be built near Atlanta on the banks of the Chattahoochee River, will have an initial rating of about 75,000 kw., produced by one turbo-generator. Three more units will eventually be installed if industrial growth warrants. Two boilers will be installed with the first machine, operating at a temperature of 725 deg. and a pressure of 450 lb. One hundred acres of land have been acquired as a site for the generating station, coal storage and a substation. It is expected that construction will begin next fall and that the plant will be from eighteen months to two years in building.

Pennsylvania Information Committee Discontinued

Announcement was made on Wednesday that the work of the Pennsylvania Public Service Information Committee has been discontinued and that its services are now being handled by the individual companies. This committee was organized in June, 1923. P. H. Gadsden was chairman and J. S. S. Richardson director. Mr. Gadsden is now vice-chairman of the Joint Committee of National Utility Associations and Mr. Richardson is director of its department of information.

Memphis Greets Visiting N.E.L.A. Engineers

More Than Three Hundred Technical Men Meet in West Tennessee City for Committee Sessions—New Voltage Ratings Approved

APPROVAL of standard voltage ratings that have been in development during the past two years was given by the executive committee of the Engineering National Section, N.E.L.A., at the section meeting in Memphis March 11 to 14. An attendance exceeding three hundred and a series of informative and energetic committee sessions on all phases of engineering in electric utilities made this meeting stand out as one of the most successful ever held by the section. No small part of the credit for that success was due the Memphis Power & Light Company for its mobilization of local facilities for inspection trips and for the comfort and recreation of those in attendance.

At this meeting was held the second convocation of the recently formed power systems engineering committee, of which L. W. W. Morrow is chairman. At the first session of the committee in January at Cleveland the general theme of system planning was developed from load studies to finance, while at the meeting this week attention was given to the engineering details of the job. Descriptions were presented of two metropolitan systems and two transmission systems. Engineering schemes and the comparative discussions that followed these papers were most effective in clarifying general conceptions of the importance of engineering programs in the continuous design and development of power systems.

Although the meetings of the power systems engineering committee perhaps attracted most notice, they did not by any means overshadow the meetings of the other groups, all of which had large attendance, interesting agenda and active discussions. These committees included those on overhead systems (Harold Cole chairman), underground systems (J. W. Sylvester), electrical apparatus (J. A. Johnson), special engineering research (C. F. Hirshfeld), inductive co-ordination (H. L. Wills), prime movers (E. B. Ricketts), meters (E. E. Hill), hydraulic power (B. E. White), engineering administration (H. P. Liversidge) and accident prevention (C. R. Beardsley). Notes on the facts brought out in reports and discussions will be printed next week

Purchases and Mergers

Six Companies United to Form the Seaboard Public Service Company, an Insull Organization with Territory in Seven States on Eastern Coast

ORGANIZATION is announced of the Seaboard Public Service Company, in which are included five light and power companies with their subsidiaries, besides a Florida ice company. The five companies, serving 509 communities in seven Atlantic Coast States, are the Virginia Public Service Company and its subsidiaries, the Eastern Shore Public Service Company and its subsidiaries, the Tide Water Power Company, the Georgia Power & Light Company and the Florida Power Corporation—all Insull-owned. Among the cities on their lines are Alexandria, Va., where the new company will have headquarters in a building to be erected by it; Staunton, Clifton Forge, Lexington, Charlottesville and Newport News, Va.; Ronceverte and Hinton, W. Va.; Vienna and Salisbury, Md.; Laurel, Del.; Wilmington, N. C., and surrounding places; Loris, S. C.; Waycross and Valdosta, Ga., and Gainesville, Ocala and St. Petersburg, Fla.

The Rochester Gas & Electric Corporation has made application to the New York Public Service Commission for authority to acquire the Bolivar-Richburg Electric Corporation, in Allegany County. There was no opposition to the petition of the Oswegatchie Light & Power Company to acquire the Rossie Electric & Manufacturing Corporation, the Hammond Light & Power Company and the La Fargeville Electric Light Company. The St. Lawrence Securities Company has asked permission to acquire the Antwerp Light & Power Company. Rossie and Hammond are in St. Lawrence County, La Fargeville and Antwerp in Jefferson County.

Two Iowa towns voted on March 7 to sell municipally owned ventures. Soldier by a unanimous vote disposed of its electric distribution system to the Iowa Public Service Company. Callender, which had owned a transmission line connecting the town with the Fort Dodge, Des Moines & Southern Railroad, from which it obtained energy, voted to sell the line.

Authority from the Illinois Commerce Commission to purchase the electric utility property at Alto Pass, Ill., has been given to the Central Illinois Public Service Company.

The Farmer City (Ill.) Council has rescinded its recent action in leasing the municipal electric plant to the Inland Utility Company and by a vote of four to two decided to retain title and continue to operate it. The Inland company has presented a new offer.

Although the City Council of Princeton, Ill., has apparently dropped negotiations with the Illinois Power & Light Corporation, which had made an offer of $600,000 for the municipal electric power, heat and water plants, a belated report of investigators employed by a citizens' committee has recommended the offer as "advantageous."

Approval of a contract for the sale of the electric distribution system at Hobart, Ind., for $100,000 to Walter A. Black is asked in a petition filed with the Indiana Public Service Commission.

Carl Hasenwinkle of Regent, N. D., has acquired ownership of the electric light system at Bison, S. D., operated by the Bison Electric Light Company.

The Western Colorado Power Company has purchased the Hotchkiss (Colo.) Power & Light Company and will serve in Delta County sixteen cities and the mining section known as the San Juan triangle.

S. E. Wolff, president Oklahoma Power & Water Company, has purchased the electric utility system at Wynona, which had purchased energy wholesale from the company.

The municipal hydro-electric plant at Franklin, N. C., it is reported, has recently been acquired by the Jupolla Public Service Company, which has also acquired a privately-owned plant on the Watauga River at Shulls Mills, N. C., and a privately owned development at Lake Tahama near Marion, N. C., as well as a transmission line from Elkin, N. C., to Roaring Gap, and is reported to be negotiating for further purchases of municipal plants in western North Carolina. The Jupolla company is a subsidiary of the Public Utilities Corporation of Cleveland, Ohio, of which R. M. Mead is president, and had previously acquired various properties in western North Carolina.

The Mississippi Power Company, which recently purchased the Blue Mountain (Miss.) lighting plant, has submitted an offer of $300,000 for the municipally owned light and water system of New Albany, Miss.

Sale of the plant and system of the Cumberland (British Columbia) Electric Light Company to the Cumberland City Council for $125,000 cash is under consideration.

Arizona Formulates New Boulder Dam Clauses

California Counters and Deadlock Persists—Conference Moves from Santa Fe to Albuquerque—Governor of Utah Approves Six-State-Treaty Bill

SUBSTITUTE proposals for a tri-state compact among the lower basin states were submitted to the Colorado River conference at Santa Fe by the Arizona delegation last week, after the California delegates had rejected Arizona's first proposals.

Chief among the provisions of the later group of proposals is one that the city of Los Angeles shall pay $2 per acre-foot for domestic water taken from the Boulder Dam reservoir for municipal use. This would mean that Los Angeles would pay the project annually about $2,190,000 for water.

On March 6 sessions of the conference were shifted to Albuquerque, N. M., where California made a counter-proposal to that of Arizona, based, apparently, on unqualified acceptance of the Swing-Johnson bill. Under the new California plan Arizona would receive 2,800,000 acre-feet, California 4,400,000 and Nevada 300,000, as in that bill. The million acre-feet remaining of the 8,500,000 under consideration would be subject to appropriation and beneficial use by any of the three states. The right acquired by such appropriation would be governed by the law of prior appropriation. California proposes that "California may use one-half of the excess or surplus waters unapportioned by the Colorado River compact, and Arizona the remaining half."

On March 9 the conference agreed to recess until April 17, at which date it will meet again at Santa Fe.

Governor Dern of Utah has signed the bill giving the consent of that state to the six-state treaty and thus making the Swing-Johnson bill valid.

Public Utilities Defended

A Thousand Attendants at Oklahoma Utilities Association Convention Hear Colonel Fogg, W. J. Hagenah and Others Praise Companies' Conduct

ALL former registration records were broken at the eleventh annual convention of the Oklahoma Utilities Association when it met at Oklahoma City on March 12 to 14 with 1,007 in attendance at the end of the second day. Approximately 600 utility men and their guests attended the annual banquet and entertainment Wednesday night. Colonel Oscar H. Fogg, New York, president American Gas Association, was the principal speaker. Referring to the Federal Trade Commission's investigation of public utilities, Colonel Fogg said that he believed a careful examination of the records to date would show that, "except for occasional detached instances of thoughlessness or misdirected zeal, the conduct of the utilities has been of a high standard and their appreciation of their responsibilities to the public such as to merit respect."

Among leaders of the industry from outside of Oklahoma who addressed the convention was Martin J. Insull, president Middle West Utilities Company, who told of the various ways of financing public utilities and advised more attention to sale of securities to customers.

James B. Wootan, Chicago, editor *Public Service Magazine*, advocated the application of old moral standards to the operation of modern business, especially that of public utilities. He declared that most utility executives are trying to apply such standards.

The subject of the state regulation and present problems of public utilities was presented by W. J. Hagenah, vice-president H. M. Byllesby Engineering & Management Corporation. Rate regulation has been a pronounced success, he said. It has caused greater efficiency in financing and operation, increased the confidence of the public in utilities, made financing cheaper and easier, enabled companies to make voluntarily rate reductions aggregating many millions of dollars and benefited both the utilities and the public. In spite of this, he admitted, there is an aggressive fight against utilities in many parts of the country based on misinformation and prejudice.

J. F. Owens, Oklahoma City, vice-president National Electric Light Association, spoke for that organization.

The electric light and power and the four other association divisions held separate meetings Tuesday and Wednesday afternoons to hear addresses and discuss various operating and public relations problems.

In the States' Legislative Mills

Bill to Control Holding Companies Loses in Indiana—Minnesota Drops State Hydro Bill — West Virginia Passes Water-Power Measure Permitting Export

OREGON and West Virginia legislators have adjourned, the latter passing the long-discussed new water-power measure before doing so. This act places no embargo on the exportation of hydro-electricity, a subject with which the Maine Legislature is still struggling. Indiana defeated the Moorhead bill to control holding companies, and Minnesota dropped the bill to put that state in the power business. New York's water-power conflict is reported under a separate heading.

INDIANA.—The Moorhead utility holding-company bill, which had been a bone of contention in several sessions of the Legislature, was killed by indefinite postponement in the House on March 7. A motion to table the postponement resolution failed by a vote of 33 to 57. It was maintained that the measure would seriously affect utility development in Indiana while litigation was pending and also would cause difficulties in cities seeking to develop their own plants through holding-corporation arrangements. The bill sought to bring holding companies owning more than 50 per cent of the stock or dominating and controlling the affairs of a utility operating in Indiana under control of the Public Service Commission.

MAINE.—Senator F. W. Carlton of Bath, father of a bill to permit exportation of water-generated electricity; Walter S. Wyman, president of the Maine Central Power Company, and others appeared before the legislative joint committee on water power on March 7 to support the measure mentioned. The arguments were the familiar ones. Senator R. F. Oakes appeared on behalf of his bill to repeal the Fernald non-exportation law outright. Senator Oakes also spoke for his bill providing for a compact between the New England States under a constitutional provision for the interchange of water power. Mr. Wyman opposed this. Representative Elli, L. Aldrich attacked exportation, advocating instead his resolution for an investigation by a recess commission. Frank W. Winter of Auburn spoke in behalf of a bill presented by Representative Sturgis to permit the organization of rural electrical companies under the general state law.

MINNESOTA.—The movement to bond the state for the purpose of "acquiring and developing water power" up to $50,000,000 has been defeated by a vote of more than two to one. The measure would have been submitted to the people as a constitutional amendment had the Legislature passed it. This measure was introduced at the sessions of 1923, 1925 and 1927 and was defeated each time.

State approval would be necessary before any dam could be erected altering the levels of any public or navigable lake, stream or watercourse within, bordering upon or adjacent to state lands, under a measure recommended for passage last week by the Senate forestry committee. Power to issue permits, under the terms of the bill, would vest in the Department of Conservation and the Executive Council.

NEBRASKA.—The Senate municipal affairs committee has reported favorably the McGowan bill prohibiting cities of the second class and villages from extension of public credit for financing enterprises where existing laws authorize issuance of bonds or tax levies and also one authorizing them to contract with private corporations and issue bonds payable out of future earnings. Several bills on the League of Municipalities' program were also reported out, granting power to cities of from 5,000 to 25,000 population to issue franchises to public utilities on a 60 per cent vote and authorizing second-class cities and villages to pledge future earnings of utility plants for repairs and extensions and permitting them to sell where a majority of electors petition and three-fourths of council and 60 per cent of electors approve. The committee refused to cut the limitation of franchises issued by second-class cities and villages from twenty-five to fifteen years, but recommended the league amendment that maximum rates shall be included in all franchises and that 60 per cent of voters be necessary to adopt.

Considerable additional testimony was taken by the Senate committee investigating activities of state university professors in connection with power-company activities. K. R. MacKinnon, superintendent of the Nebraska Power Company, said that co-operative experiments with the state agricultural engineering department had been largely financed by the power companies and had been well worth while because of what the companies thus learned.

The ambitious bill before the House creating a bureau of water conservation and utilization, to be directed by Prof. Clark E. Mickey, head of the civil engineering department of the Nebraska State University and supporter of the oft-discussed Tri-County combination power and irrigation project, has been indefinitely postponed.

NEW YORK.—Under the provisions of a bill introduced by Assemblyman Kelly of Utica, a new section would be added to the Public Service Commission law providing that no gas or electric corporation shall suspend service for non-payment of disputed bill and requiring five days' notice of suspension in every city of 50,000.

Under the provisions of a bill introduced by Senator Thayer, a temporary state commission would be created to make thorough survey, examination and study of the operation of the Public Service Commission law, to report on or before March 1, 1930. An appropriation of $40,000 is made.

A vigorous protest was made on behalf of large property owners in New York City at a hearing before the Senate committee on public service against the bill introduced by Senator Thayer, chairman of the committee, to give the Public Service Commission jurisdiction over submetering by landlords. Clarence J. Shearn, who appeared for the New York City Real Estate Board and the Building Owners' and Managers' Association, quoted figures to show that a provision in the bill prohibiting the resale of electrical energy on the submeter plan would make necessary the scrapping of millions of dollars' worth of equipment. He declared that the landlords charged only the retail rates charged by the New York Edison Company, which would be the gainer if the bill was passed with this provision in it.

NORTH CAROLINA.—The Hancock education bill passed by the Senate and sent to the House for concurrence involves an increase in the tax on the gross receipts of power companies from 1 to 2 per cent. The committee estimated that the increase in power taxes would yield $300,000.

NORTH DAKOTA. — Among bills passed recently by the North Dakota General Assembly is one broadening the power of the Board of Railroad Commissioners in regulating public utilities. Another measure ratified authorizes village trustees to contract for street lights and public utility services.

OHIO.—Repeal of the Pence law, under which utilities were allowed to collect rate increases before these were authorized by the Public Utilities Commission, has been accomplished. The repeal bill as passed provides for the creation of a fact-finding committee within the utilities commission, the superintendent of which is to be appointed by the commission, said superintendent to be executive secretary of the commission. The commission is also to appoint and have jurisdiction over the attorney-examiners, engineers, accountants and other investigational experts, who are not to have civil service law protection. The law also requires that applicants for rate increases furnish a complete analysis of the unit costs in valuation, an inventory of property, operating figures and a statement of income and expense anticipated under the applicabtion filed. The bill has had the backing of Governor Cooper, who will doubtless sign it.

OKLAHOMA. — The Austin-King bill making it unlawful for any one to operate any electrical machine which will cause interference with the operation of a radio without grounding the machine has been advanced to third reading with an amendment excluding from its provisions domestic machinery and appliances. The Watson bill relating to the method of assessing corporations by the State Board of Equal-

ization, but exempting public service corporations from its provisions, was passed by the House and referred to the Senate committee on revenue and taxation. A bill defining public utilities was reported unfavorably by committee, but placed on the calendar on vote of the House. The Black bill authorizing municipalities to own and maintain property outside of corporate limits and to issue bonds for same was passed by the House.

OREGON. — The Legislature has adjourned without the passage of any act much affecting the status of utility companies. At the request of its author the bill providing for the taxation of undeveloped water power at the rate of 50 cents per horsepower was withdrawn.

The Senate bill providing for the withdrawal of the waters of the Rogue River from power development requiring dams or other obstructions in the main channel passed both houses and when this was written was in the hands of the Governor. His approval was doubted since the people last fall defeated a similar proposal by an overwhelming vote.

WEST VIRGINIA. — The water-power bill described last week (page 506) passed the House in the closing days of the session, now over, and will become a law. Its most radical departure from the provisions of the old bill, which had not been amended since 1915 despite many efforts, lies in the clause governing exportation of energy. Under the old law the exporting of electrical energy generated in West Virginia was restricted and permits could be granted only to corporations chartered under the laws of the state. Under the new law there is no such inhibition, and differences between those who advocated a liberal export policy and those who advocated restriction have been reconciled apparently through a provision that the reasonable needs for electric power and energy on the part of the state and consumers in the state who can reasonably be served by the licensees shall have preference as compared with the needs of others. In short, there is no embargo imposed upon transporting power beyond the confines of the state, the matter being left largely to the commission to regulate. Other provisions were printed last week.

WISCONSIN.—Terming the Wisconsin income tax law as it relates to public utilities a "hodgepodge" of inconsistencies, Assemblyman Alvin C. Reis, Madison, argued last week before the judiciary committee in favor of his bill which provides that all public utilities shall pay an income tax. "The present law makes public utilities a favored business," Mr. Reis said. "There is no justice in the fact that ordinary corporations must pay an income tax while the utilities are exempt."

Two new bills affecting public utilities are to be reported by committees. One of them would strengthen commission control of public utility securities; the other would provide for the creation of electric power and lighting districts for the development and distribution of electric power. Provisions of the first bill are (a) that no refunding securities can be issued without authority of the commission and that the commission shall have the same right to limit the amount of refunding securities that it now has as to original securities; (b) that the commission shall have power to limit the amount of securities which may be issued by a corporation against property secured by the purchase of the property of other utility corporations. The latter right is now exercised by the commission, but is disputed. The second bill provides that the bonding power of a district set up shall be based on the assessed valuation of all of the municipalities included in the district, that the district shall have the power to purchase or construct plants for the development and distribution of electric power, and that any existing utilities within the district must be taken over by the power district at a valuation to be fixed by the Railroad Commission.

A bill to prohibit water-power development on Wolf River has been drafted. It is supported by citizens specially interested in the preservation of scenery.

Roosevelt Has New St. Lawrence Scheme

New York Governor Proposes State Development by Trustees, Distribution by Private Industry—Rates to Be Fixed by Contract, Not Set by Commission

IN AN address to the New York Legislature on Tuesday last Governor Franklin D. Roosevelt explained his eagerly awaited plan for water-power development in that state. The Governor confined himself to the St. Lawrence River and presented to the leaders of the two houses a bill prepared by him to carry out his ideas, for which he solicits bipartisan support. The two principles underlying the proposed measure are thus epitomized by the Governor in his speech:

1. The natural water-power sites on the St. Lawrence now owned by the people of the state or hereafter to be recovered should remain forever inalienable to the people, and any dams or plants necessary to generate power shall be built, financed, owned, operated and occupied by the trustees [five men to be appointed by the Governor with the consent of the Senate and known as "the trustees of the water-power resources on the St. Lawrence River"], as the duly constituted instrumentality of the state.

2. Power developed therefrom shall be transmitted and distributed, if possible, through the employment of private capital so as to secure adequate distribution throughout the state. This distribution, however, shall secure the lowest rates to consumers compatible with a fair and reasonable return on actual cash investment. The rates, in other words, shall be based on actual cash outlay—that is to say, operating expenses, capital outlay representing money actually spent in plant investment and working capital, with reasonable allowance for obsolescence and depreciation—and a return on the investment not exceeding the interest actually paid on borrowed money and dividend rates not in excess of current rates on preferred stock and not to exceed 8 per cent on all other cash capital. In other words, the power generated by the agency of the state, called the trustees, shall be sold only on a contract basis which will take into definite consideration all the steps between the sale at the power house and the ultimate sale to the home owner or industrial establishment.

It will be seen that the Governor's measure resembles closely in most respects that supported by his predecessor, Alfred E. Smith, substituting, however, the trustees for the latter's proposed "water-power authority." The trustees are to have authority to issue tax-exempt bonds as instrumentalities of the state, but will not have power to pledge the credit of the state. They will have, however, more explicit functions in regard to arranging for the transmission of the power than were bestowed in last year's bill, and in one point their functions will be enlarged as compared with those then proposed, for, if the bill passes as it stands, it will be their duty to enter into contracts with the distributors of the power, fixing the rates to be charged at a price to bring an 8 per cent return on the investment. Thus the St. Lawrence development would be taken out from under the control of the Public Service Commission, which under Governor Smith's plan would have fixed the rates.

The bill cannot be passed without the concurrence of the Republican leaders or, in the event of their opposition, the rebellion of a considerable number of their followers. It is sure to have the support of the Governor's own party, which is in a minority in both houses. In his speech the Governor said:

Everything points to the practicability of building a dam. Furthermore, it is my judgment that no insuperable difficulty lies in the relationship betwen the State of New York on the one side and the United States government or the Canadian government on the other side. To appoint a mere commission to make inquiries would get us nowhere—unless we create a body with authority to make, subject to the approval of the Legislature, definite agreements on the basis of a definite, carefully worked out plan.

In the same way, a mere investigating body could get nowhere with conversations with the representatives of private capital in regard to transmission and distribution of power, whereas a body clothed with authority to negotiate with transmitters, distributors and bankers on the basis of a comprehensive and definite plan stands an excellent chance of accomplishing results.

I propose, therefore, the creation of a body of five representative citizens, regardless of political considerations, to be known as the trustees of the water-power resources on the St. Lawrence River. It is my thought that these trustees should be composed of men in whom there is great public confidence, such as former Governor Charles Evans Hughes and former Governor Alfred E. Smith.

Northwest Commercial Men at Spokane

Power, Merchandising, Lighting and Rural Committees Put Many Suggestions and Points of View Before Association Gathering

RURAL electrification, from the point of view of volume of material presented, formed the principal subject of discussion at the fourth annual mid-winter conference of the Commercial Section of the Northwest Electric Light and Power Association at Spokane on February 28 and March 1 and 2. This does not mean that any one of the twelve other subjects grouped under the three bureaus, Power, Merchandising and Lighting, was slighted, for the entire field of commercial activity in the territory was spread open through committee reports and discussion. Talks by Chairman Lewis A. Lewis, J. E. E. Royer and M. L. Hibbard stressed the necessity for intensive commercial effort. Outside viewpoints on farm electrification were expressed by Dr. E. C. Holland, president Washington State College, and Fred W. Clemens, *Washington-Oregon-Idaho Farmer*.

Power Bureau meetings heard reports from the commercial cooking, industrial heating and power committees, presented respectively by C. J. Anderson, Carl Hoffman and E. E. Scofield. Mr. Scofield said that the maximum rate at which electric power could compete with Diesel engines in North Pacific Coast territory was 1½ cents per kilowatt-hour.

For the Merchandising Bureau, G. A. Kumler reported for the domestic range committee, Glenn L. Jackson for the domestic refrigeration committee and J. W. Wisdom, Jr. for the water-heating committee. All these reports brought out useful and up-to-the-minute facts on their respective subjects. The major portion of the report of the general merchandising committee, presented by H. W. Cooper, dealt with the question of sales organization.

Defining a promotional rate as one designed to induce the customer to use to a maximum the facilities required to serve him, the conclusion of the promotional rate committee, for which Thomas M. Gibbes reported, was that the greatest effect on increasing consumption and revenue was derived from a reduction in the price of the second step, with the greatest differential between the first and second steps; that the next effective influence was derived from a decrease in the sum produced by the first step, and that lowering the price of the first step had the least influence. Discussion called attention to the alleged bad psychology of the readiness-to-serve charge.

Lighting Bureau reports were from the electrical advertising committee, by T. W. Fitch; the home educational committee, by Fred Zaugg; the commercial and industrial lighting committee, by L. B. Gowan, and the street and highway lighting committee, by George M. Boyd.

The program of the rural electrification committee, with J. C. Scott as chairman, took the form of a symposium on how farm load could and should be developed. Selling to the farmer, co-operation with dealers, equipment and demonstration, farm specialists and organization of a rural department and advertising and literature were topics treated separately in a prepared symposium. One session was devoted to the subject "Developing an Appreciation of the Value of Electric Service on the Farm" from different viewpoints, that of the power company being presented by A. C. McMicken.

Beauharnois Hydro Project Sanctioned

Dominion Government Approves Development to Produce Half Million Horsepower and Cost $65,000,000—Water-Power Control Reverts to Western Provinces

CANADA is likely to see another very large hydro-electric plant added to those she already possesses. The Dominion government has sanctioned the application of the Beauharnois Light, Heat & Power Company for approval of plans for a power canal between Lake St. Francis and Lake St. Louis on the St. Lawrence River. The scheme involves a diversion of 40,000 sec.-ft. and will enable the company to proceed with an initial power development of 500,000 hp. It is estimated that the project will cost about $65,000,000. The decision of the government concludes a long controversy between rival power interests in Montreal.

Stipulations are attached to the government's approval. Probably the most important is a provision that should the Dominion authorities at any future time desire to use the canal constructed by the Beauharnois interests as a part of the Greater St. Lawrence shipway, this substantial link will become the property of the people of Canada free of charge. There are thirteen additional provisions. These are designed to protect the interests of the Dominion government should it be found that some of the water-power rights belong to the Dominion instead of the Province of Quebec. In such case the company would have to pay the Dominion treasury a yearly rental. It is also provided that the Department of Public Works shall have engineering control over the construction. The company must do nothing that will interfere with treaty operations between Canada and the United States.

The company's plans provide for a canal 14 miles long and 4,000 ft. wide, with its power house at the Lake St. Louis end. It has been estimated that the 83-ft. fall of water, with an average flowing capacity of 40,000 sec.-ft., could be harnessed to generate 2,000,000 hp. should this power be required. The power house for the initial installation of 500,000 hp. will be 186 feet in height. The first unit will contain ten generators, each with a capacity of 50,000 hp.

Some months ago the project was approved by the Quebec government, which has granted the Beauharnois company a lease for 75 years with the restriction that no electric power shall be exported from Canada nor may power be sold to a company that exports electrical energy. Permission, however, is granted for the sale of power to the Province of Ontario.

As the result of a resolution adopted by the Canadian Parliament on March 6, the Provinces of Manitoba, Saskatchewan and Alberta will have control of millions of dollars' worth of water powers which heretofore have been vested in the Dominion government. The resolution provides for the return of natural resources to the three prairie provinces, and its adoption is the climax to a battle which has been vigorously waged by the provinces for several years.

Briefly, the resolution provides that no disposition of water powers in the three provinces mentioned shall in future be made under the Dominion water powers act, but they shall be administered by the respective provinces under powers to be granted by the Canadian Parliament similar to the powers granted to the Province of British Columbia in the railway belt. Applications of two New York organizations for water-power sites in the mineralized belt of northern Manitoba and one similar application from a Chicago interest are affected by this decision.

The federal Parliament's decision will have a very important bearing on the water-power situation in the province of Manitoba, where, owing to unusual activity in mining, there is bound to be a scramble for the most suitable power sites during the next few years. The recent lease of the Seven Sisters Falls power site on the Winnipeg River to the Winnipeg Electric Company is but one example of the interest being displayed by private companies in the water-power resources of the Western province.

J. S. Woodsworth, labor member for Winnipeg, who champions the public ownership of utilities, complained that sanction of the Seven Sisters Falls lease to the Winnipeg Electric Company by Manitoba was given by the Dominion Minister of the Interior without reference to Parliament. Defending his action in this regard, the minister, Charles Stewart, pointed out that there were two difficulties in connection with the Seven Sisters Falls. One was that the Winnipeg Electric Company already had a right to take from it in perpetuity 9,000 sec.-ft., the other that the same company owned all the land surrounding the development under discussion.

Much stir is being raised in Winnipeg over the Manitoba government's action in leasing Seven Sisters Falls. Charges

of accepting money from the company have been leveled against certain members of the government, two ministers have resigned, and an investigation is being held. A. W. McLimont, former president of the Winnipeg company, who resigned in January because of ill health and is now in Los Angeles, was, the press announced, to be asked to testify by commissioners sent to that city from the province. The company is reported to be going right ahead with the twenty-five-million-dollar development, and the Manitoba government has announced that if the legality of the lease is questioned a bill will be introduced in the Legislature to validate the transaction.

It is announced that the Winnipeg Hydro Department will spend $2,321,000 during the current year on new construction, of which $1,000,000 will go to preliminary work on the new Slave Falls power project on the Winnipeg River. The total sum to be spent by the Hydro is almost double last year's appropriation. So great has been the growth in the demand for power in Winnipeg that approximately $1,000,000 a year capital outlay is required for extensions to the distribution system alone, according to J. G. Glassco, manager of the department.

Off-Peak Power for Export?

Addressing a meeting in Toronto recently, George A. Henry, a member of the Ontario provincial Cabinet, made the prediction that the sale of off-peak power to the United States would produce a revenue that in time would create reserves sufficient to reduce the charges to Hydro consumers in Ontario. He explained that this off-peak power exported to the United States could not be used in Ontario and that the contracts for its sale could be quickly terminated in case a demand for it should arise in the province.

Water-Power Again Theme of Commerce Chamber Men

Water power in relation to fuel-burning plants and to agriculture formed the principal topic of discussion at the second meeting of the water-power policies committee of the United States Chamber of Commerce, held in Washington on February 27 and 28. Comparisons of hydro-electric and steam power were made with reference to quantities produced, cost of generation, transmission and distribution, percentage of total delivered cost attributable to generation cost, and relative opportunity for increase in efficiency. The relation of water power to irrigation and to nitrogen fixation also came up for notice, well-known authorities giving their views.

Other subjects considered in part related to the extent and ownership of water-power resources, to rates and regulations, and to interstate transmission of power. The committee is expected to make recommendations in the spring or early summer.

Proceedings for Cincinnati A.I.E.E. Meeting

Papers on Automatic Stations, Welding High-Speed Instruments, Measurements, Power Systems, Iron Losses and Other Topics Promise Excellent Meeting

A WIDE range of technical subjects is covered in the completed program for the regional meeting of the Middle Eastern District of the American Institute of Electrical Engineers, which will be held at Cincinnati, March 20-22, with headquarters at the Hotel Gibson. Four technical sessions are scheduled.

A session on student activities will be held on the morning of Thursday, March 21, and there will be luncheon meetings for branch counselors and branch chairmen on that and the preceding day. On Thursday evening there will be a dinner meeting with addresses by President Schuchardt and other prominent men. The technical program follows:

WEDNESDAY, MARCH 20

Morning.—Address, Vice-President, J. L. Beaver; address, Mayor Seasongood; address, President R. F. Schuchardt; "Recent Developments in Telephone Construction Practices," B. S. Wagner and A. C. Burroway, Cincinnati & Suburban Bell Telephone Company; "Illumination of Airports and Airways," H. E. Mahan, General Electric Company; "Iron Losses in Turbo-Generators," C. M. Laffoon and J. E. Calvert, Westinghouse Electric & Manufacturing Company.

Afternoon.—Automatic Stations and Welding: "Street-Railway Power Economics," J. A. Noertker, Cincinnati Street Railway Company; "Automatic Mercury-Arc Rectifier Substations in Chicago," A. M. Garrett, Commonwealth Edison Company; "Arc Welding of Steel Buildings and Bridges," F. P. McKibben, General Electric Company; "Fabrication of Large Rotating Machinery," H. V. Putman, Westinghouse Electric & Manufacturing Company; "Electrical Equipment for Continuous Bar, Plate and Hot-Strip Mills," J. B. Ink, Dwight P. Robinson Company.

THURSDAY, MARCH 21

Afternoon.—High-Speed Instruments and Measurements: "High-Speed Photography in Electrical Engineering," H. W. Tenney, Westinghouse Electric & Manufacturing Company; "Oscillographs for Recording Transient Phenomena," W. A. Marrison, Bell Telephone Laboratories; "A New Type of Hot-Cathode Oscillograph," R. E. George, Purdue University; "Bushing-Type Current Transformers for Metering," A. Boyajian and W. F. Skeats, General Electric Company; "Excitation of Current Transformers Under Transient Conditions," D. E. Marshall and P. O. Langguth, Westinghouse Electric & Manufacturing Company.

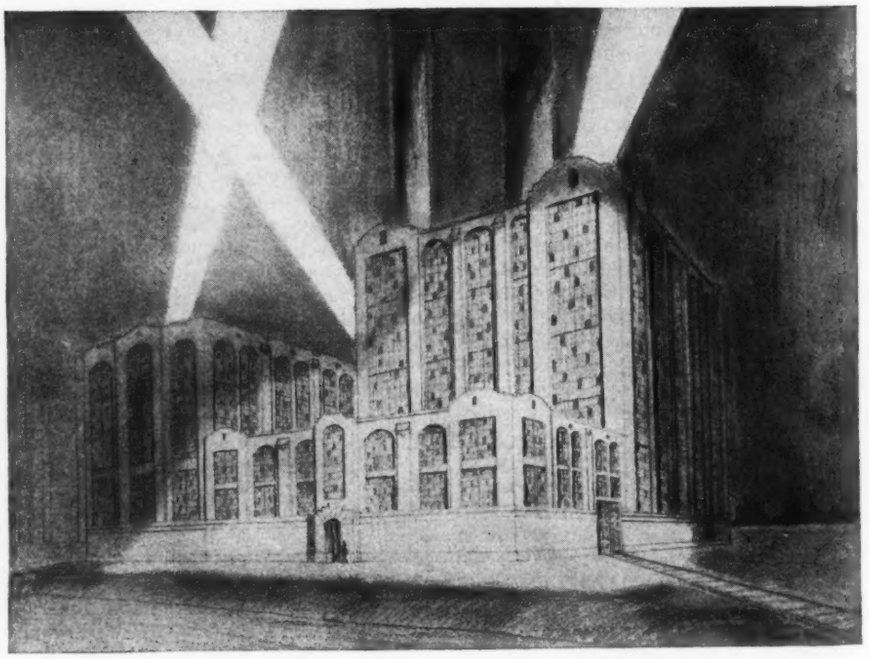
FRIDAY, MARCH 22

Morning.—Electric Power Systems: "Fused Horns and Grading Rings," P. B. Stewart, Union Gas & Electric Company; "Operating Experience with the Low-Voltage Alternating-Current Network in Cincinnati," F. E. Pinckard, Union Gas & Electric Company; "Recent Additions to Generating Capacity on the System of the Columbia Gas & Electric Corporation," E. S. Fields, Columbia Engineering & Management Corporation; "Investigation of Transmission Lines with Artificial Lightning," K. B. McEachron, General Electric Company.

"Pocket Veto" of President Before Supreme Court

Much interest was manifested by those specially connected with the Muscle Shoals agitation when in a hearing on March 11 before the United States Supreme Court the attorneys for certain Washington State Indians attacked as invalid the "pocket veto" in 1926 by President Coolidge of a bill

Coming Reed Power Station at Brunot Island



AS PREVIOUSLY announced, the James H. Reed power station to be built by the Duquesne Light Company at Brunot Island, Pittsburgh, of which the architect has drawn from the plans an exterior view in the style of modern art, will have an initial rating of 60,000 kw. This installation will cost about $10,000,000. Construction work started late last year, and the plant is expected to start up in the summer of 1930.

Ultimate plans call for the building of five power units with a total rating of 300,000 kw., at a cost of about $40,000,000. This building program will require ten years.

affecting these Indians' rights. Although the pocket veto has been exercised by Presidents since the early days of the Republic, this is the first time that its scope has been submitted for interpretation to the Supreme Court. The contention is that the constitutional provision making ineffective a bill submitted to the President less than ten days before the close of a session of Congress and not signed or returned by him applies only to the final session of each Congress and not, as has heretofore been assumed, to any session, and that bills so treated at sessions other than the last automatically become law. The issue hinges on the meaning of the word "adjournment" as applied to Congress.

As printed in these columns at the time, Senator Norris and other supporters of the Muscle Shoals bill which met with a pocket veto from President Coolidge last year have consistently refused to admit that his action put an end to the measure. Should the Supreme Court rule that a pocket veto cannot be exercised over a bill passed in any save the last session of Congress, the Norris Muscle Shoals bill, in common with others, will, it is to be presumed, automatically become law.

Consumers Power to Go to 60 Cycles in West Michigan

The Consumers Power Company, Jackson, Mich., will immediately begin work on a program having as its purpose installation of a complete 60-cycle electric supply system for Grand Rapids, Muskegon and 45 other communities of western Michigan to supplant the present equipment, which operates on a frequency of 30 cycles. The plan contemplates steps covering a period of years and will cost upward of $6,000,000, or an average of about $60 for each customer in the territory. These hundred thousand customers, Vice-President C. W. Tippy points out, will benefit far more than the company.

Work in the current year will be largely of preliminary character—laying out the temporary system of apparatus for making the actual change-over. Included, however, is the installation of a large new substation in the southern outskirts of Grand Rapids together with the installation of duplicate bus structures and connections in existing substations in Grand Rapids and Muskegon. These will make available two different sources of supply, one of 30-cycle and one of 60-cycle frequency, so that when the circuits and customers' appliances and equipment are ready the change can be made without delay or appreciable interruption of service. The company expects that 1929 and 1930 will be required to put its own system in order for the actual operation of changing over and that none of the motors, appliances and other equipment on customers' premises will be reached prior to 1931. Grand Rapids will be looked after first, followed by Muskegon and the other communities on a schedule designed to avoid interruptions.

Briefer News

WEST FLORIDA POWER CORPORATION BUILDS STATE'S LARGEST HYDRO PLANT.—Construction on the Jackson Bluff hydro-electric plant of the West Florida Power Corporation, which will supply energy to north and west Florida, including Tallahassee, and to the southern Georgia territory served at present by the Georgia Power & Light Company, is being rushed to completion. The plant, which will be the largest hydro-electric station yet built in Florida, is on the Ocklocknee River, 26 miles west of Tallahassee. It will have an installed capacity of 13,000 hp. in three units and will be capable of producing annually 32,000,000 kw.-hr. The earthen dam, already completed, will create a lake 15 miles long and from 1 mile to 4 miles wide.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

American Society for Testing Materials — Stevens House, Chicago, March 19-22. C. L. Warwick, 1315 Spruce St., Philadelphia.

American Institute of Electrical Engineers—Regional meeting, Cincinnati, March 20-22; regional meeting, Dallas, Tex., May 7-9. F. L. Hutchinson, 33 West 39th St., New York.

American Society of Mechanical Engineers—Knoxville, Tenn., March 21-23. C. W. Rice, 29 West 39th St., New York.

Northwest Electric Light and Power Association — Engineering Section, Walla Walla, Wash., March 25-27. Berkeley Snow, 1206 Spalding Bldg., Portland, Ore.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 4-6. Lee C. McCullough, 134 South Central Ave., Phoenix.

Maryland Utilities Association—Emerson Hotel, Baltimore, April 12. D. E. Kinnear, 803 Court Square Bldg., Baltimore.

American Welding Society—Engineering Societies Bldg., New York, April 22-26. M. M. Kelly, 29 West 39th St., New York.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Indiana Electric Light Association — Hotel Gary, Gary, Ind., May 1-3. William Stokes, 1548 Consolidated Bldg., Indianapolis, Ind.

East Central Division, N.E.L.A. — Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

National Electric Light Association—Atlantic City, N. J., June 3-7. A. J. Marshall, 420 Lexington Ave., New York.

LONG-RANGE SEARCHLAMPS FOR EUROPEAN FORTRESS.—Searchlamps completed at Croydon, England, for installation in a Continental fortress are among the largest ever made, being nearly 7 ft. in diameter. The candle power is approximately 3,500,000,000, and the light would be visible for hundreds of miles if the limitations of the horizon could be overcome and good weather conditions prevailed. They are distantly controlled by electricity and arranged for working up to an elevation of 90 degrees.

PIONEER ONTARIO MUNICIPAL PLANT FREE OF DEBT AFTER 30 YEARS.—The town of Orillia, Ontario, recently celebrated thirty years' public ownership of its water-power development. In 1899 the Town Council began to generate electrical energy on the Severn River and bring it to Orillia, a distance of 25 miles. This was the first municipally owned long-distance-transmission electric plant in Canada. On February 14 the Orillia commission celebrated the payment of the last dollar of principal and interest on the original loan of $75,000 for power-plant purposes.

ARMY ENGINEERS REPORT OPTIMISTICALLY ON RAPPAHANNOCK POWER SITES.—A preliminary survey by United States Army engineers, extending over a period of three months, has disclosed great power possibilities in the Rappahannock River above Fredericksburg, according to Hugh L. Scott of the engineering branch of the army. The survey has shown, said Mr. Scott, that the construction of two power dams above Fredericksburg is entirely feasible. The survey disclosed one drop of 100 ft. in 13 miles and another of 54 ft. in 5 miles.

NEW GORGAS PLANT WILL OPERATE IN MAY.—Progress in constructing the first 60,000-kw. turbo-generator, referred to as Unit No. 4, in the new Gorgas steam plant of the Alabama Power Company being erected across Baker's Creek, opposite the present plant, has kept pace with schedule, and it is expected that the plant will be ready for testing about April 1 and go into operation in May. Ultimately the plant is to have four 60,000-kw. units. It will rank among those representing the latest practice in steam-electric generating stations consistent with fuel costs in Alabama and will embrace all auxiliaries and features for efficient base-load generation.

BRITISH PREPARE TO CELEBRATE FARADAY CENTENARY IN 1931.—Preliminary plans for the celebration of the centenary in 1931 of Faraday's epoch-making discoveries have been made in London at a meeting of representatives of scientific, electrical and

otner societies held at the Royal Institution under the presidency of Sir Arthur Keith. The time chosen provisionally for the celebrations was the third week in September, 1931, and it was decided to set up two small committees, representing the scientific and industrial interests, to make the necessary plans and to insure that the celebrations shall be attended by interested persons from all parts of the world.

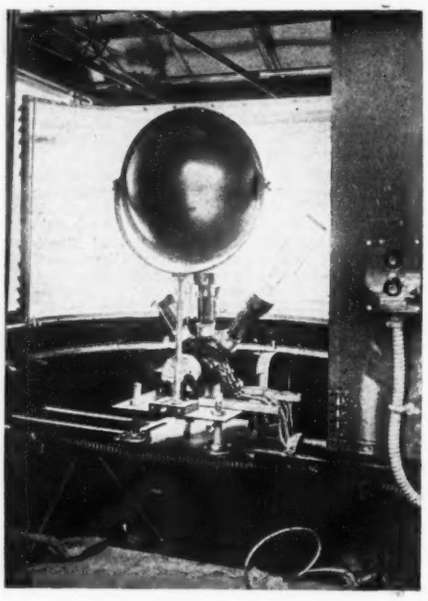
ANOTHER LINE TO BE BUILT FROM STAVE FALLS TO VANCOUVER, B. C.—Erection of a 60,000-volt high-tension line by the British Columbia Electric Railway Company from the Stave Falls electric plant to the Horne Payne distribution station of the company, outside the city of Vancouver, will be carried out in the near future. The approximate cost of the structure will be $130,000 and wooden poles will be used. The transmission line will follow virtually the same route as the existing high-tension system of the company.

HEARING AT ALBANY, N. Y., ON MATTER OF UNIFORM RATE FORMS.—There was a further hearing before the New York Public Service Commission last week in the investigation of uniform rate forms for electricity and gas throughout the state. N. T. Selman, representing the Consolidated Gas Company, New York City, and M. E. Skinner of the New York Power & Light Corporation were examined by counsel for New York City, the Gas Consumers' League and the city of Jamestown. The next hearing, on a date to be announced, will be held in the city of New York.

SHORTAGE OF WATER THREATENED IN NORTHWEST.—There is a difference of opinion in Oregon regarding prospects for the supply of water for power purposes in that state. State Engineer Luper contends that, owing to a liberal fall of snow in the mountains, streams and rivers furnishing the supply will remain at a fair level throughout the year. Utility operators are not so optimistic, believing that the hydro-electric plants are going to face a serious shortage because of a remarkable absence of rainfall in the interior of the state. Government weather records show that Oregon is short of rainfall to the extent of 12 in. All of the important watercourses in the state are at summer level, and nothing but an unprecedented fall of rain will cause them to reach a high level, according to local bureaus. Similar conditions prevail in Washington and in British Columbia.

EL PASO ELECTRIC COMPANY TO BUILD 54,500-KW. PLANT THIS YEAR.—An expansion and improvement program which will require an expenditure of approximately $5,500,000 will be carried out at El Paso during the current year by the El Paso Electric Company, subsidiary of the Stone & Webster interests, according to F. C. Gannon, general manager of the company. The most important feature of the plans is the construction of a new power plant, for which a 70-acre site has just been purchased. The power plant, fully equipped, will cost $4,800,000, Mr. Gannon said, and its capacity will be 54,500 kw. It will be interconnected with the present power plant of the company, but the latter will be used as a "standby" unit for emergency purposes. Water for condensing purposes will be obtained from the Rio Grande. The new plant will number among its customers the Nichols Copper Company, which will operate a new copper refinery at El Paso.

NEW TYPE OF SEARCHLAMPS FOR NIGHT FLYING INSTALLED AT BOLLING FIELD.—The illustration is an interior view of one of a new type of searchlamps installed at Bolling Field Washington, to guide night fliers. The apparatus contains three tungsten bulbs on a holder so arranged that when one burns out the next automatically slides into place and is lighted.



IOWA POWER AND INDUSTRIAL CONFERENCE.—The annual Iowa power and industrial conference, under the auspices of the State University of Iowa, will be held at Iowa City on April 2 and 3. The conference will be attended by electric light and power and electric railway men, Iowa manufacturers, coal operators, city officials and representatives of unions. Some of the subjects to be discussed are the power facilities of Iowa, power as a factor of production, power utilization in Iowa industries and extension of manufactures in Iowa. The conference is called by Dean C. C. Williams of the College of Engineering.

TWENTY-FOUR HYDRO SITES ON DESCHUTES RIVER IN LITIGATION.—An unusually widespreading water-power contest is now before the Oregon Supreme Court, which convened on March 6 to listen to arguments on the determination of relative rights to the waters of the Deschutes River and its tributaries. Eighteen briefs were to be presented and 24 power sites are involved. The case is being appealed by the Cline Falls Power Company from a judgment of the Deschutes County Court in which the adjudication order of the State Engineer was upheld. The appellants base arguments for a reversal on parts of the engineer's order which are declared to be confiscatory.

PRESIDENT HOOVER HONORED BY SAN FRANCISCO ENGINEERS.—One hundred and seventy members of the Engineers' Club of San Francisco paid tribute to their fellow member Herbert Hoover on the evening of March 4, the day of his elevation to the Presidency. John L. McNab, attorney of San Francisco, who placed Mr. Hoover in nomination at the Kansas City convention, made the principal address. Among club members present were six past-presidents of the five founder societies—Charles D. Marks, C. E. Grunsky, Arthur P. Davis, Dr. Harris J. Ryan, Dr. C. E. Franklin and Dr. W. F. Durand. President Louis F. Leurey of the club presided.

NOTHERN CALIFORNIA COMPANIES TO PAY FOR RURAL LINES ON CUSTOMERS' PROPERTY.—President Thomas S. Louttit of the California Railroad Commission has announced that, as the result of informal negotiations conducted by Charles Grunsky, head of the gas and electric division of the commission, and representatives of the California Farm Bureau Federation, the Pacific Gas & Electric Company and the Great Western Power Company are adopting a new extension rule which will provide for the construction of electric lines on private property in the rural sections of their territories at the expense of the companies. Heretofore these companies have built their lines along the public highways and roads only. The consumers have paid for those portions of the lines on private property. Privately owned lines of rural electric consumers will be purchased by the companies upon an equitable basis, dependent upon the class of construction and conditions in each particular instance.

MINING COMPANY'S ELECTRICAL SERVICE TO MUNICIPAL PLANTS IN ILLINOIS ATTACKED.—The Illinois Power & Light Corporation has instituted injunction proceedings in the Circuit Court at Carlinville, Ill., attacking municipal light and power contracts entered into by several mining communities near Staunton, Ill., with the Consolidated Coal Company of St. Louis for its surplus power. Through the Consol Power Company, a subsidiary with a power plant at White City, Ill., the coal-mining interests serve Mount Olive, White City and Staunton, and they had started to extend their lines to Williamson and Livingston, served by the Illinois Power & Light. That company claims that such extensions are an invasion of its territory and cannot be made without authority from the Illinois Commerce Commission. The mining

company claims that sale of energy wholesale to a municipality owning its own distribution system is not engaging in public utility business. The Consol plant has slashed rates where it has obtained contracts, agreeing, for instance, to sell to Williamson for 3 cents a kilowatt-hour.

COMPANY OBTAINS INJUNCTION IN LITTLE ROCK RATE FIGHT.—The Arkansas Power & Light Company has obtained a federal court injunction against the submittal to vote of the initiative measure mentioned last week reducing its electrical and street-railway rates. The company held that the proposed reduction of rates for energy from 10 cents (maximum) to 7 cents per kilowatt-hour and of railway fares to 5 cents would cause it a loss of $230,000 a year in the first instance and $120,000 in the second, thus becoming confiscatory. It also contended that the question of rates cannot under the Arkansas constitution be properly submitted to the voters, and the court sustained this view. An appeal is talked of.

EXPANSION OF BALTIMORE COMPANY'S TERRITORY.—As a result of various acquisitions by the Consolidated Gas, Electric Light & Power Company of Baltimore during the year, the company has extended its territory to the Pennsylvania line on the north, to the Susquehanna River and the Chesapeake Bay on the northeast, and to a short distance from the District of Columbia on the south, according to the annual report, just issued. The company thus serves from its own and controlled lines all of Baltimore city, the whole of Baltimore and Anne Arundel Counties, all but a very small part of Harford County and substantial parts of Carroll, Howard, Prince George's and Montgomery Counties, aggregating about 1,395 square miles.

ABERDEEN, WASH., RECORDS FURTHER PLANS FOR HYDRO PLANT.—The city of Aberdeen, Wash., has filed with the state hydraulics supervisor data additional to those contained in previous preliminary filings for water rights on the Wynooche River in Gray's Harbor County. Aberdeen desires to launch a power and municipal supply project, to cost $5,200,000. This undertaking, which may be under construction by January 1, 1931, in the event that the permits are issued, would enable Aberdeen to maintain an electric power plant with an estimated output of 35,000 hp. The power house would be immediately adjacent to the proposed Weatherwax Dam, which would be built in the upper Wynooche district, 14 miles northeast of Humptulips. A concrete dam 265 ft. in height, with a 1,100-ft. top measurement and a bottom length of 120 ft., is contemplated. Between two and three years would be needed for its completion. The hydraulics supervisor has also received an application for water rights on the Humptulips River, in the same county, from R. H. Stock of Aberdeen, who will develop 2,000 hp.

THE BABSON RELIEF MAP OF THE UNITED STATES.—Progress on the great relief map of the United States which Roger Babson and his associates, together with the Babson Institute, are building at Babson Park, Mass., and which the ELECTRICAL WORLD described on Oct. 4, 1924 (page 760), is outlined in a folder just issued by the national map committee which has the work in charge. More than $150,000 has been expended thus far, including the cost of the building, but since less than 40 per cent of the country's area is yet provided for, additional funds are necessary. Winslow L. Webber, secretary of the committee at Babson Park, announces that relief maps for those sections of the country which have government surveys can now be furnished to utility companies and others desiring them.

Commission Rulings

SPECULATIVE PROFITS ON PURCHASE BY OWNER OF UTILITY CONDEMNED.—Ruling that public utilities in Missouri are not intended for and shall not be made the basis of speculative profit taking, the Missouri Public Service Commission has denied the application of the North Central Telephone Company to purchase telephone exchanges at seven points. The North Central proposed to pay $80,000 for the seven exchanges. The commission, after an investigation, held it could not approve a property value of more than $56,000, although the company placed a value of more than $100,000 on the plants. Records are said to show that one of the owners of the North Central company had secured an option to purchase the properties for $70,000. "What justification is there for a utility owner to purchase property and sell it to the company he owns at a profit to himself?" the commission asked.

RESERVATIONS MADE BY INDIANA COMMISSION IN APPROVING STATE LINE GENERATING COMPANY CONTRACTS.—In approving the contracts made by the State Line Generating Company with the four Insull companies that are to be supplied with power from the State Line plant now being erected near Hammond, Ind., the Public Service Commission of Indiana made certain conditions. It said that the agreement should be asked for a shorter period than fifty years unless the right of the commission to inquire into all phases of operation and to enforce strict and faithful compliance with the terms of the contract both with regard to operating costs and the rates charged were conceded. This observation was made because of the jurisdictional complications that would arise in view of the interstate character of the commerce. The commission also reserved the right to fix the rate of return, the rate of depreciation and the amount of working capital of the generating company, and it disapproved parts of the contract that might be understood as leaving these functions to the utility itself. The commission finally made a reservation safeguarding the availability of supply to the Indiana consumers as compared with the Illinois distributing companies.

Recent Court Decisions

MEASURE OF DAMAGE TO LAND FROM SEEPAGE BECAUSE OF DAM.—The Supreme Court of Nebraska, in affirming a judgment obtained by Henry J. Weilage against the Blue River Power Company, sustains the ruling of the trial court that where damages by reason of the construction of a power dam have been established the measure of recovery is the difference between the reasonable market value of the land immediately before being overflowed and subjected to seepage and the reasonable market value immediately thereafter.

HIGH-TENSION WIRES WHICH INJURED CLIMBING BOY NOT AN "ATTRACTIVE NUISANCE."—The Supreme Court of Kansas has reversed a judgment for damages because of injury from electric shock to a thirteen-year-old boy who climbed to the top of a viaduct used to enable pedestrians and vehicles to cross railroad yards and while walking there, 25 feet above the floor of the structure, came into contact with high-tension lines of the Kansas City Public Service Company, the defendant in a suit brought by the boy's guardian, Anderson. The plaintiff claimed that the company carelessly permitted boys to play on the viaduct and that the wires were an "attractive nuisance." (273 Pac. 397.)*

WHERE EVIDENCE SHOWED THAT HIGH VOLTAGE ENTERED BUILDING ON SERVICE WIRES FAILURE TO PROVE ANOTHER ALLEGATION IS NOT FATAL TO CASE.—In Moyer vs. Blue Mountain Electric Company, damages were recovered for the destruction by fire of a hotel against which service wires swayed, on the allegation that excess current entered the building over them through the company's negligence. The Supreme Court of Pennsylvania sustained a judgment for the plaintiff, declaring that the jury was the proper judge of the disputed facts, that the failure to prove a further charge of improper grounding of a transformer was not so material as to upset the verdict, and that where, as in the case under review (in which the customer was injured by the escaping electricity), the facts spoke for themselves, the burden of disproving negligence was on the defendant. (144 At. 131.)

DEFECTIVE TRANSFORMER COULD NOT START FIRE.—The United States Court of Appeals in Missouri has reversed the verdict for $120,000 damages awarded in November, 1927, against the Illinois Power & Light Corporation in favor of the Cain-Hurley Lumber Company of East St. Louis, Ill. A jury in the lower court found that the power and light company had been negligent in keeping a defective transformer adjacent to the lumber company's plant in Brooklyn, Ill. It was contended that this transformer had caused a fire which destroyed the lumber company's mill and yards early in 1922. The reviewing court held that the jury should have been directed to return a verdict for the power company. It observed that the jury could only guess whether the transformer had caused the fire, while expert testimony offered by the defense was that the transformer could not have started the fire.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

H. McRary Jones Appointed to New Position in Canada

Hamilton McRary Jones, manager of the department of the Americas of the Westinghouse Electric International Company, has recently resigned from that organization to become general manager of the International Power Company and vice-president of the Montreal Engineering Company in Montreal, Canada. Following graduation from the University of North Carolina in 1905 Mr. Jones entered the graduate student apprentice course of the Westinghouse Electric & Manufacturing Company. After a year in that capacity he was assigned to field erecting work for the company, at which he remained for one year. Later Mr. Jones left the Westinghouse company and spent four years as electrical engineer for the South Porto Rico Sugar Company at Ensenada, P. R. In 1911 he became superintendent of the lighting division of the Porto Rico Railway, Light & Power Company, San Juan, in which position he remained for three years.

After severing his connections with the Porto Rico utility Mr. Jones became manager in Japan for the Westinghouse Electric International Company in 1914. He remained for five years in this position with headquarters in Tokyo, and in 1921 was sent to Mexico to open a branch office, after which he was placed in charge of the Chilean State Railway electrification work as conducted by the Westinghouse company. This work lasted for two years, at the completion of which he was appointed manager of the department of the Americas for the Westinghouse company. Mr. Jones is a member of the American Institute of Electrical Engineers, the University Club of Pittsburgh, the Machinery Club of New York and the American-Japan Society, of which he is a charter member.

J. S. Watson Named Vice-President of Link-Belt

James S. Watson has been elected vice-president of the Link-Belt Company with headquarters at the company's Dodge Works in Indianapolis, Ind., according to an announcement made from the executive offices of the company. A native of Philadelphia, Mr. Watson has been with the company continuously for 34 years, having entered the employ of its Philadelphia plant when he was barely out of his "teens." In January, 1903, after eight years' experience in various departments, the management selected him to take charge of the exploitation of Link-Belt silent chain as a power-transmitting medium. The silent chain at that time was new, as it had only been introduced to industry in the year 1900.

For the past nine years Mr. Watson has been located at the company's Dodge Works in Indianapolis, of which he is general manager in full charge of the production of Link-Belt silent and roller chain drives, and from which point he also continues to be responsible for the selling of these drives, as well as herringbone speed reducers, through a group of power transmission engineers located in practically all of the principal cities.

SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, sailed for Genoa March 16 aboard the Lloyd-Sabaudo liner *Conte Grande* for a short sojourn abroad.

F. H. GEYER has been appointed illuminating engineer for the Philadelphia Suburban-Counties Gas & Electric Company with headquarters in Philadelphia.

R. M. WATT, manager of the Kentucky Utilities Company's southeastern Kentucky station at Pineville, Ky., known as the mountain district, has been appointed general chairman of a national committee formed by the American Mining Congress to study the use of electric power in the mines. This committee is to make a five-year survey of the use of machinery in the production of coal.

Dr. Rüdenberg Visits America

Dr. Reinhold Rüdenberg, chief electrical engineer of the Siemens-Schuckertwerke, is at the present time in this country on an extended visit. He has just completed a series of lectures on the newer fields for research in applied electricity at the Massachusetts Institute of Technology, Cambridge, Mass. Professor Rüdenberg has been serving at the Technical College at Berlin since May, 1913, and has been honorary professor since 1926. In 1921 he was awarded the honorary degree of doctor of engineering by the Technical College at Karlsruhe. In 1911 the Montefiore Institute of Belgium awarded him its prize for the most distinctive achievement in electrical technology. In order to continue to combine activity as a teacher with practical work in industry he has declined calls to other institutions.

H. H. Porter Heads Engineering Foundation

H. Hobart Porter has been elected chairman of Engineering Foundation, joint research instrumentality of the Founder Engineering Societies, to succeed L. B. Stillwell, who has served since 1925. Mr. Porter has long been active in business, engineering and science, as well as in the educational and civic life of New York. He is president of the American Water Works & Electric Company and of the Brooklyn City Railroad Company. He is chairman of the board of the West Penn Electric Company and vice-president of the Queensboro Gas & Electric Company.

Mr. Porter is a director of the Washington Water Power Company, West Penn Railways Company, West Penn Power Company, West Penn Monongahela Company, Missouri Pacific Railroad, New Orleans, Texas & Mexican Railroad, Rio Grande City Railway Company and other transportation companies. He is a member of the division of engineering and of the executive committee of the National Research Council, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers. He became a member of the Engineering Foundation board in May, 1918, serving until February, 1924. He was re-elected to the board in 1927. Mr. Porter was born in New York City in 1865 and was engaged in mining engineering in Mexico and Arizona until 1894, when he became a member of the engineering firm of Sanderson & Porter, New York, with which he has since been identified.

P. G. WHITMORE, formerly connected with the distribution engineering department of the West Penn Power Company in Pittsburgh, has severed his connection with that company to become identified with the Electric Bond & Share Company of New York. Mr. Whitmore will engage in distribution engineering work in Mexico.

J. A. PEARSON, vice-president in charge of purchasing of the United Gas Improvement Company, has tendered his resignation effective April 1. Mr. Pearson has been in the employ of the United Gas Improvement organization for 40 years. In making the announcement John E. Zimmermann, president of the company, said: "I regret to announce the resignation of J. A. Pearson, vice-president in charge of purchasing,

effective April 1. Mr. Pearson's retirement is at his own suggestion and is in pursuance of a determination of several years to retire from business upon the completion of 40 years of service with the company. Under Mr. Pearson's administration the purchasing department of the U. G. I. has been brought to a very high standard and has acquired an enviable reputation in the public utility field."

C. M. GARLAND has assumed the duties of director of engineering for the firm of Garland & Scribbins, recently incorporated. Mr. Garland's department will include power, heating and industrial installations. John A. Scribbins will occupy the position of director of architecture, including the supervision of office, school, apartment and hotel buildings and the architectural treatment of industrial plants. Headquarters are in Chicago.

H. S. Nonneman Assumes New Duties in Dayton

H. S. Nonneman, formerly illuminating engineer with the Dayton Power & Light Company, has been appointed to the position of assistant to the vice-president of that company. Mr. Nonneman was graduated from the electrical engineering school of Ohio State University in 1921 and upon the completion of his technical education he entered the National Lamp Works of the General Electric Company. Three years was spent at Nela Park, in Cleveland, where work was done on the photo-electric cell that is so important today in the transmission of photographs by wire, and also in television. Later he became a member of the statistical department of the Jersey Power & Light Company, and after several months he was appointed illuminating engineer.

CHARLES D. FITCH, superintendent of the underground department of the Toledo Edison Company, has retired from active service after a connection of 37 years with the Toledo utility.

J. F. KELLY, manager of the appliance bureau of the New York Edison Company, New York, has resigned to become affiliated with the Dover Manufacturing Company of Dover, Ohio, manufacturer of electrical appliances. Mr. Kelly has been named vice-president of the company and will have his offices in the Graybar Building, New York City. He entered the employ of the New York Edison Company in 1906. For a time he was an agent in the contract and inspection department and later was made acting manager and then manager of the bureau of special canvassers. In 1924 he was made manager of the appliance bureau.

P. M. Wentworth Given Broader Responsibilities

P. M. Wentworth of Orlando, Fla., has been named district manager of the companies comprising the southeastern district under the executive management of Stone & Webster of Boston. The companies include the Jacksonville Traction Company, Key West Electric Company, Tampa Electric Company, Columbus Electric & Power Company, Savannah Electric & Power Company, the Florida Motor Lines, the Orange Belt Motor Lines, the Orlando Rapid Transit Company and the South Terminal Company. Since 1927 Mr. Wentworth has been executive vice-president of the Florida Motor Lines and affiliated companies, moving to Orlando from Sidney, N. S., where he was manager of the Cape Breton Electric Company, Ltd. Mr. Wentworth will maintain his headquarters at Orlando.

Obituary

William G. Kerckhoff

William G. Kerckhoff, one of California's pioneers in hydro-electric development and an organizer and leader of public utilities, died in his seventy-third year, of a heart attack, at his home in Los Angeles, Feb. 24. He was born at Terre Haute, Ind., in 1856, removing to California in 1878. He entered the lumber business in Los Angeles, later organizing an ice company. The ice plant was driven by water power and was the forerunner of hydro-electric development in southern California. With associates he formed the San Gabriel Power Company and built a plant on the lower San Gabriel River, transmitting the power to Los Angeles for distribution. This led to association with the late Henry E. Huntington and the formation of the Pacific Light & Power Company, which was succeeded by the Pacific Light & Power Corporation, the latter subsequently being merged with the Southern California Edison Company. The urge of further utility development led to construction of the Kern River plant and later to the launching of the Big Creek project. In 1902 Mr. Kerckhoff and associates acquired the properties of the San Joaquin Light & Power Corporation and developed 180,000 hp. for supplying the San Joaquin Valley. During his career he had been president of the Southern California Gas Company, the San Joaquin Light & Power Corporation, the Fresno Farms Company and the South Coast Land Company. In addition he had been associated with many other enterprises.

ARTHUR H. ALLEN, for many years the technical editor of our British contemporary the *Electrical Review*, died February 13 as the result of pneumonia. Serving his early apprenticeship with a Scottish firm of electrical engineers, he won a first Pender gold medal in electrical engineering at the Glasgow and West of Scotland Technical College and later, for two years, was assistant to the late Professor Andrew Jamieson in the same college. From 1890 to 1894 he gained practical experience with an electrical engineering firm in the north of England and then removed to London as a demonstrator and lecturer on electrical design under the late Professor Ayrton at the Central Technical College, Kensington. Mr. Allen joined the editorial staff of the *Review* in 1899 as technical sub-editor, assuming the position of technical editor in 1921. He was a member of the Institution of Electrical Engineers and was 56 years of age.

JOHN WOLFF, for many years mechanical engineer of the Cleveland Electric Illuminating Company, died suddenly, of heart disease, on March 2. He had been active up to the time of his death and had attended to his duties at the office the day before. After graduating from Stevens Institute of Technology with the class of 1888, Mr. Wolff spent some time with the United States Electric Company of Newark and then ten years with the Brooklyn Edison Company, followed by two years with the Mahoning Valley Railroad, as chief engineer.

T. F. MERSELES, president of the Johns-Manville Corporation, died March 7, of heart disease, at Del Monte, Cal., at the age of 65. In the course of a varied and interesting career his talent for merchandising and organization proved to be his greatest asset and his leadership in this field won national recognition. In 1903 he threw his lot in with the mail-order business. Joining the National Cloak & Suit Company, he remained eighteen years as vice-president and general manager and during this period the business grew from $1,000,000 to $50,000,000 a year. Early in 1921 he became president of Montgomery Ward & Company of Chicago, having been engaged by J. P. Morgan & Company to guide that organization out of its post-war deficit. When he relinquished the duties of chief executive in 1927 the mail-order house had again become a leader in its field. In spite of the fact that he knew nothing about the asbestos business, the Morgan interests sent him to the Johns-Manville Corporation as president in 1927 and under his régime the company prospered. At the time of his death, in addition to being president of the Johns-Manville Corporation, he was chairman of the executive committee of Montgomery Ward & Company, director of the Northern Pacific Railway Company, the J. I. Case Threshing Machine Company of Racine, Wis., the Continental & Commercial Bank in Chicago and a trustee of the Mutual Life Insurance Company of New York.

Financial and Statistical News

——Electrical equipment manufacturers show very satisfactory results from 1928 operations. Westinghouse reports a gain in gross earnings of 7.7 per cent and of almost 29 per cent in net manufacturing profits, American Brown Boveri shows gross income up 105 per cent, Timken Roller Bearing reports manufacturing profits up 36 per cent and Worthington Pump gained more than 50 per cent in manufacturing profits.

——Continued money firmness is evidenced by the rate of 4¾ per cent on currently offered Treasury certificates. Rumors persist of an impending increase in the Federal Reserve rediscount rate in New York.

——Power and light common stocks have shown no definite trend this week. While a few specialties have made advances, the average is about where it was a week ago.

——Activity still further slackens in the bond market. Says the current market letter of Stone & Webster and Blodget: "That period of tremendous stock market activity extending from 1899 to 1906 was in many respects similar to the one through which we are now passing. The volume of monthly average stock sales on the New York Stock Exchange increased more than 100 per cent, while monthly average bond sales declined more than 25 per cent, thus indicating the same lack of interest in bonds, as compared with stock equities, that now prevails."

Two Electric Bond & Share Companies Unite

Stockholders of the Electric Bond & Share Securities Corporation and of the Electric Bond & Share Company March 12 voted to unite the two companies and to split up the common shares of the Securities Corporation on a three-for-one basis.

The new company formed through the union of the two old corporations, to be known as the Electric Bond & Share Company, will issue 500,000 shares of $6 preferred stock in exchange for 500,000 preferred shares of the Electric Bond & Share Company now outstanding, and 9,615,306 shares of common stock in exchange for 3,205,102 shares of the common stock of the Securities Corporation now outstanding.

The assets which will be owned by the new company had a market value of $1,075,750,012 on February 28, it was stated at the meeting.

Canadian Companies Float New Loans

Thirty-year convertible debentures, series B, of the Power Corporation of Canada have been offered the investing public to the amount of $10,000,000, the price being 100 and accrued interest. These securities, bearing interest at the rate of 4½ per cent, were dated March 1, 1929.

Proceeds will be used for investment in carefully selected securities. These debentures may be converted at the option of the holder at any time before March 1, 1934, into common shares without nominal or par value of the company on the basis of $150 per share.

The Shawinigan Water & Power Company issued first mortgage and collateral trust sinking fund gold bonds amounting to $6,000,000 at 93 and accrued interest, yielding over 4.90 per cent.

Electric Shareholdings New Investment Company

With assets aggregating in the neighborhood of $65,000,000 the Electric Shareholdings Corporation has been organized as a public utility investment or holding company. The organizers are closely identified with the Central States Electric Corporation and the Hydro-Electric Securities Corporation. Public financing will shortly be announced in connection with this organization.

Holdings of the late Captain Alfred Loewenstein, Belgian financier, will be among the first assets acquired by the new corporation, it is stated. The Hydro-Electric Securities Corporation, a Canadian organization, has control of public utility holdings of more than $50,000,000, and the utility securities now being sold by this corporation to the Electric Shareholdings Corporation represent an interest in American properties. The banking house of the J. Henry Schroeder Banking Corporation figures prominently in the organization.

The new board of directors will include men prominent in the public utility field. L. E. Kilmarx will be president. Frank L. Dame and two other directors of the Central States Electric Corporation are also included, as well as Herbert C. Freeman and Edwin Gruhl. The Hydro-Electric Securities Corporation will be represented by several of its own directors, including C. L. Fisher, Albert Pam, Prentiss N. Gray, etc. The other directors will include Murray Dodge, director and vice-president of the Chase Securities Corporation; John Foster Dulles of Sullivan & Cromwell, New York, and John L. Simpson, vice-president of the J. Henry Schroeder Banking Corporation.

Protest Being Filed Against General Electric, Ltd.

Following the issue in Great Britain of ordinary shares of the General Electric Company, Ltd., which can be purchased only by British subjects and corporations, a protest is now being filed with the State Department at Washington against the exclusion of American investors in the right to participate. It is stated that about one-sixth of the capital of the company is now held in the United States. A protective committee of American stockholders has been appointed, with Thomas L. Chadbourne as chairman.

The new committee is sending a protest to the British company and a copy is also being sent to the Secretary of the Treasury at Washington and to the Federal Reserve Board.

In a cablegram received from Hugo Hirst, managing director and chairman of the board of the company, it is stated that American investors now hold 60 per cent of the stock of the General Electric Company, Ltd. In his cable Mr. Hirst said he believed the protest was based on a misunderstanding and he had no desire to disturb the good relations between England and America. He said the redemption of the company's debentures, for which the new stock is to be issued, would make an additional £60,000 available for the ordinary stockholders, regardless of their nationality. He said, however, that the fact of the 60 per cent ownership in this country might have a damaging effect from a trading point of view. Mr. Hirst said that the board must remain ultimate arbiter in guiding the company's affairs. The shareholders of the British company have ratified the action of the directors with only a negligible protest on the part of British shareholders.

Cities Service Issues Fifty-Million-Dollar Offering

The largest offering made up to the present time this year by an electric light and power company was made by the Cities Service Company this week in the form of 5 per cent gold debentures amounting to $50,000,000. These securities, dated March 1, 1929,

and maturing March 1, 1969, were priced at 97½ and interest. Each $1,000 debenture will carry a warrant entitling the holder to purchase, subject to the indenture provisions regarding stock dividends, recapitalization, etc., ten shares of common stock of the company during the period extending from March 1, 1929, through March 1, 1932, at prices ranging from $122 per share to $150 per share.

The directors at a special meeting held March 12 voted to split the company's common shares four for one, subject to the approval of the stockholders at their annual meeting next month. If this action is approved the present 5,500,000 common shares of $20 par value will be changed to 22,000,000 shares of no-par value.

The Electric Investors, Inc., issued 40,000 shares of $6 preferred stock at $99 per share and accrued dividends, to yield over 6 per cent. Proceeds will provide funds for the acquisition of additional interests in electric power and light companies and for other corporate purposes.

First and refunding mortgage 4½ per cent gold bonds of the Public Service Company of New Hampshire were offered to the amount of $1,000,000 at 94½ to yield about 4.85 per cent.

Great Rise in Energy Output in January

The production of electricity by public utility power plants in January exceeded all previous monthly records, with a total output for the month of 8,219,000,000 kw.-hr., an increase of 4 per cent over the output for December, 1928, and of 13 per cent over the output for January, 1928, according to the U. S. Geological Survey. This exceeded the output for the entire twelve months of the year 1905.

Indicating an abnormal lack of water supply in power streams from October to January, the survey report points out that the output by the use of fuels has increased rapidly since July, but the output by the use of water has gradually decreased since June, the output for January being less than for January, 1928. The increase in fuel output has resulted in a large increase in the consumption of fuels in the second half of the year. Comparing July, 1928, and January, 1929, the amounts of coal consumed were respectively 3,170,000 tons and 4,112,000 tons; oil, 553,000 bbl. and 876,000 bbl.; gas, 6,895,000,000 cu.ft. and 8,049,000,000 cu.ft.

The scarcity of water power is particularly evident in the returns for the upper Mississippi Valley and for California. For the entire country the output by the use of water power in January was only 33 per cent of the total. This is the lowest ratio since September, 1927.

The quantities given are based on the operations of all plants producing 10,000 kw.-hr. or more per month, engaged in generating electricity for public use, including electric railway plants.

American & Foreign Power to Issue Rights

The stockholders of the American & Foreign Power Company, Inc., at a special meeting held at Augusta, Me., approved the issuance to stockholders on March 11 of rights to subscribe to $100,827,200 additional stock, in the form of units of one share of second preferred stock, series A, entitled to cumulative dividends at the rate of $7 annually, and four-tenths of an option warrant to purchase common stock of the company for $25 a share in cash.

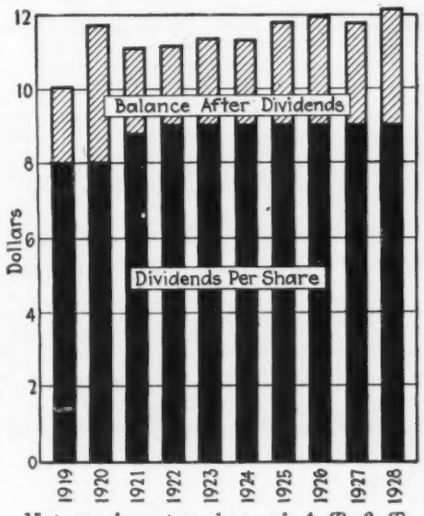
The stockholders also approved an increase in the authorized capitalization of the company in order to provide for this offering, which is made on the basis of 10 per cent of holdings to all stock and option warrants outstanding.

The Electric Bond & Share Company has agreed without cost to the American & Foreign Power Company to take the balance of the $100,827,200 of subscriptions for the above units not subscribed for. As it also owns about 65 per cent of the American & Foreign Power Company's stock, it is assumed that its participation in this offering will approximate $65,000,000.

American Telephone & Telegraph Breaks All Previous Records

Company Will Spend Nearly Half Billion Dollars in 1929 on Construction—Transatlantic Telephone Cable Now Under Way

NET INCOME of $143,170,491 out of total earnings of $235,781,978 by the American Telephone & Telegraph Company exceeded all previous records and amounted to $12.11 a share earned on the average number of shares outstanding during the year, as against $11.76 a share in 1927. This is an advance of 11.3 per cent in net earnings, while expenses advanced only 6 per cent.



Net earnings per share of A. T. & T. stock available for dividends

The company paid out dividends during the year exceeding $100,000,000 for the first time in its history, the total being $103,821,440. The balance after dividends, of $39,349,051, was also a record; that of the previous year was $31,234,976.

The American Telephone & Telegraph Company passed another landmark during the year in that its balance sheet of December 31, 1928, was the first issued since the company became a two-billion-dollar corporation. Its assets amounted to $2,213,327,685. The total assets of the entire Bell system, including American Telephone & Telegraph and its 24 associated telephone operating companies, amounted to $3,826,683,584.

During 1928 the Bell system spent more than a million dollars a day, a total exceeding $428,700,000, on construction, and it has been stated by Walter S. Gifford, president of the company, that 1929 expenditures will probably exceed this amount. He added that expenditures for the next five years will undoubtedly be in excess of $1,900,000,000, which amount was spent during the past five years.

The volume of transatlantic telephone business continues to increase and has at times overloaded the radio-telephone facilities. A short-wave channel is now in use supplementing the long-wave channel. Increasing use and further development of transatlantic telephony will require further facilities. During the year the research engineers of the Bell Telephone Laboratories perfected a means of making a transatlantic telephone cable. This cable, when constructed and laid, will not only substantially increase the facilities for transatlantic communication but will also provide a circuit of maximum reliability. In the meantime, radio-telephone transmission is being further developed and more transatlantic radio channels are planned.

There is also under way the establishment of a short-wave channel between the United States and Argentina which should meet the initial requirements for telephone communication between the two countries.

SOUTHEASTERN POWER & LIGHT COMPANY announces that instead of the quarterly cash dividend of 25 cents per share, the directors have declared a quarterly dividend, payable in the company's common stock, on April 20, 1929, on the basis of 1/100 of one share for each share of common stock registered as of March 30.

Record Manufacturing Activity During February

MANUFACTURING operations of the country in February, based on consumption of electrical energy for power purposes, were of record proportions. The February rate of operations, after corrections are made for the number of working days, was 6 per cent over January, 10 per cent over February of last year and 0.3 per cent over the previous high rate of operations set in September, 1928.

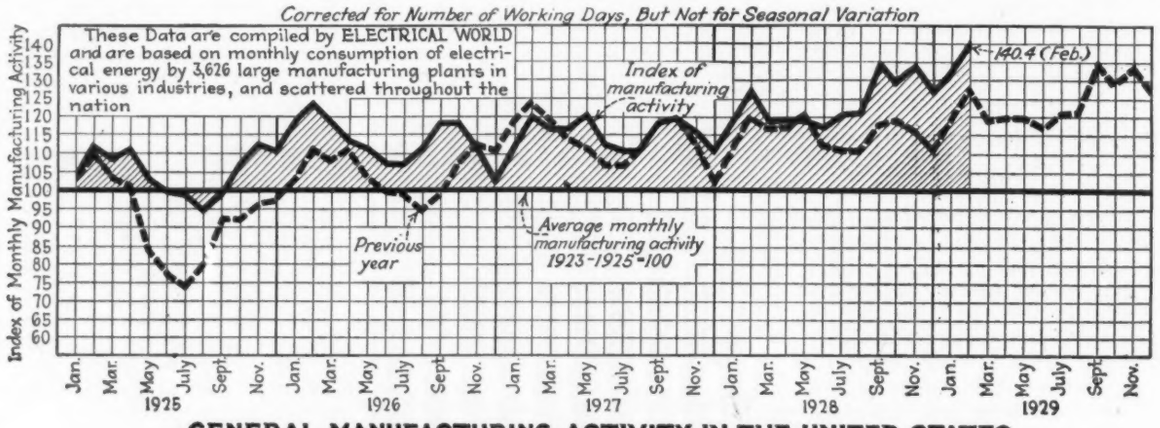
New high rates of productive activity were set by five of the country's primary industrial groups—rolling mills and steel plants, metal-working plants, rubber products, automobile manufacturing, including replacement parts and accessories, and the chemicals and allied products industrial group. The rolling mills and steel plants reached new heights in the rate of productive activity, recording a rate of operations 22.1 per cent over February last year and 6.4 per cent over the previous high mark set by the industry in January this year. Ferrous and non-ferrous metal-working plants were operating on a plane 20.5 per cent over February last year and recorded an increase of 6.6 per cent over the previous high mark of activity set last September.

The automobile industry, including the manufacture of replacement parts and accessories, rose to new heights in February with a rate of operations 8.1 per cent over January, 8.6 per cent over February last year and 0.3 per cent over the previous high mark set in September last year.

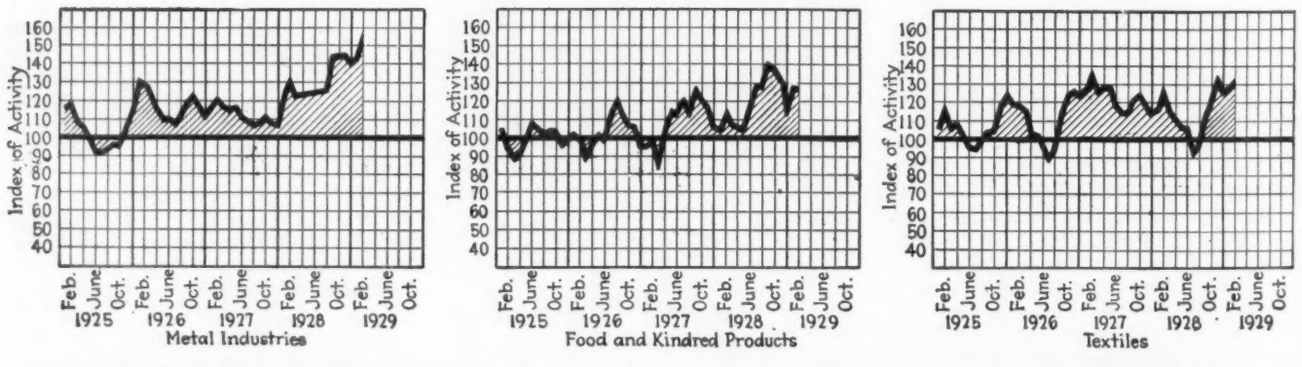
Only two country-wide primary industrial groups recorded a rate of operations during February under that recorded during February last year. The leather products industry increased its rate of activity slightly during February, but was still operating on a plane about 14 per cent under February last year. Operations in the forest products group during February were 5.0 per cent under February, 1928. With the volume of residential construction on the downward grade there seems to be little chance of this industry materially increasing its output in the near future.

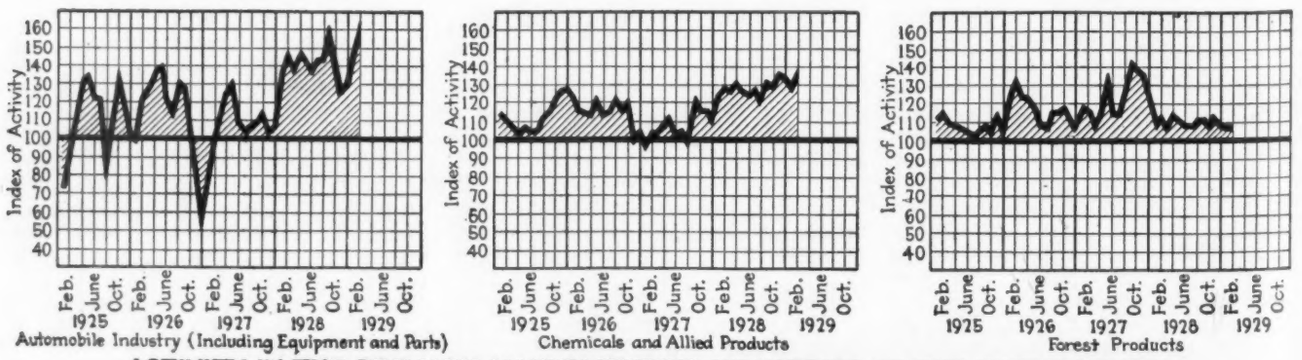
All of the sections of the country reported a rate of operations over that of February last year. Sectional increases over last year were: New England, 6.1 per cent; Middle Atlantic, 3.2 per cent; North Central, 17.1 per cent; South, 2.2 per cent, and the Western States, 12.6 per cent. In New England and the North Central sections the February rate of operations were of record proportions.

MORISON ELECTRICAL SUPPLY COMPANY SELLS STOCK. — An issue of 16,000 shares no-par common stock of the Morison Electrical Supply Company, Inc., has just been sold. Part of this issue is for exchange of the outstanding 8 per cent preferred stock of the corporation and the balance is being issued to provide additional working capital.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
140.4 (Feb.)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES





ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Market Conditions

New Building Code Allows Use of Welding

Thirty-eight municipalities on the Pacific Coast now have sections in their building codes covering the electric welding of buildings, according to an item in the *General Electric Review* for April. These cities, now operating under the regulations laid down by the Uniform Building Code, have followed the lead of Sacramento and Alhambra, which adopted that code late in 1927.

According to the new building code section for these cities it is now legal for the commissioner of buildings in each place to grant, in the same manner as for riveted frames, permits for the erection of electrically welded steel building frames also.

In addition to the 38 municipalities, there are many cities in which the code is either now being adopted or the ordinances are being prepared. In the eastern section of this country various organizations have been at work for some time on a building code incorporating a section covering welding.

Change Recommended in India Import Duties

An early action for the removal of the present import duty of 15 per cent ad valorem on electrolytic copper rod has been recommended to the Indian government. An import duty of 5 per cent ad valorem on rubber-insulated electrical wire and cables other than those specified under statutory item 90A of the Indian customs tariff, and dutiable at 15 per cent ad valorem, namely, insulated copper wires and cables, any one core of which has a sectional area of less than 1/80 part of a square inch, and wires and cables of other metals of not more than equivalent conductivity, also is recommended.

Copper Reaches 20 Cents

An advance in the price of copper from 19½ to 20 cents per pound, delivered Connecticut Valley, was the only feature of the past week in the nonferrous metal markets. But little change has been reported in lead, zinc, tin or any of the metals of lesser importance.

The release of the A.B.M.S. copper statistics on March 12 served to inform buyers that the strong position of the producers had been enhanced in February. A strong demand developed in the domestic market immediately following release of the A.B.M.S. figures and as a result the price in the domestic market was quickly forced up to 20 cents per pound.

NEW YORK METAL MARKET PRICES

	Mar. 6, 1929 Cents per Pound	Mar. 13, 1929 Cents per Pound
Copper, electrolytic	19.50	20
Lead, Am. S. & R. price	7.25	7.25
Antimony	9.25	9⅛
Nickel, ingot	35	35
Zinc, spot	6.70	6.35
Tin, Straits	48.625	48.63
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Mar. 13, 1929, 21¼ cents

Shipments of Electric Locomotives

Shipments of mining and industrial locomotives for the quarter ended December 31 last, as reported to the Department of Commerce by ten firms comprising practically the entire industry, were 184, valued at $1,149,678, as against 141 locomotives, valued at $860,305, for the previous quarter. Totals by quarters for the past two years are shown in the table above.

1927		
Quarter ended:		
March 31	283	$1,372,225
June 30	233	1,053,812
September 30	193	898,970
December 31	173	866,106
Annual total	882	$4,191,113
1928		
Quarter ended:		
March 31	133	$728,629
June 30	111	729,458
September 30	141	860,305
December 31	184	1,149,678
Annual total	569	$3,468,070

*Principles of Business Conduct**

Relations of Manufacturers to Customers, Agents or Others

1. Commissions should not be paid to consulting engineers or others receiving compensation directly or indirectly from the person or corporation for whose use the apparatus is being purchased.

2. Electrical manufacturers should not absorb losses due to mistakes made by customers or their representatives.

3. The manufacturer should not seek to reopen contracts already closed or cause the buyer to feel dissatisfied with his decision.

4. The manufacturer should not pay for catalog space, but it is proper for him to furnish information and electrotypes.

5. Efficient market development of the electrical industry requires the co-ordination of promotional activities in all of its branches. The electrical manufacturers indorse the collection and disbursement of funds and the control of all promotional activities in accordance with a unified plan and by an agency acceptable to the major branches of the industry.

6. The condition of shopworn or otherwise depreciated products, sold at reduced prices, should be indicated on the invoice.

Competitive Bidding

1. The electrical manufacturers indorse the principle of a one-price policy.

2. A request for competitive prices on the part of a buyer involves definite obligations toward all bidders. The electrical manufacturers indorse as in the interest of sound, ethical and economic relations between buyer and seller the following principles to apply to competitive bidding under any specific inquiry:

(a) That the bids be considered as confidential information between buyer and bidder until all bids are in and the buyer has placed the business.

(b) That bidders exchange, where practicable, full information regarding their bids after the business is placed.

3. Where specifications call for various items involving different types and classes of apparatus, the relative merit of the different bids is best determined and freedom of choice on the part of the buyer promoted if each bidder quotes segregated prices at which any individual item would be accepted.

**Presented before Policies Division, and indorsed by the board of governors, N.E.M.A.*

Market Conditions

——The firmness and anticipated further advance in copper prices is reflected in higher quotations for certain classes of equipment, hence heavier buying, especially in the Eastern district. Motors particularly are active. Prime movers also are a feature of this week's business in the Eastern area.

——In the Middle West the steel and automobile industries are giving rise to a gratifying volume of business. Some important railroad orders also are reported. The St. Louis district records some fair business in small and medium sized apparatus.

——The volume of business reported on the Pacific Coast this week is below normal. Power company orders featured what contracts were placed.

Power Station Orders Feature Southeast Business

The larger central stations are beginning to dip into their budgets and central-station purchases are showing improvement in the Southeast. A brisker activity is noted in industrial lines also, with inquiries and orders satisfactory. The largest power company order placed was for 132-kv. oil circuit breakers and lightning arresters amounting to $100,000, being ordered by a Tennessee company. The distribution transformer orders of a Georgia company totaled something over $22,000 and an Alabama company ordered four 2,500-kva. transformers for industrial installation. Bids have been asked and received on equipment to go into a 100,000-hp. steam plant to be constructed by the Georgia Power Company on the Chattahoochie River near Atlanta and costing in excess of $7,000,000. This same company will order during the coming week substation equipment aggregating $500,000.

A cotton bag mill in Alabama ordered mill equipment amounting to $90,000, the principal item on this order being individual drive motors. A lumber mill in Florida ordered a 1,500-kw. turbine, condensers and motors totaling $65,000, while a $30,000 condenser order was placed by a North Georgia cotton mill. Another cotton mill in the same state ordered $15,000 worth of motor equipment, while a third textile plant in the state ordered $2,000 worth of mill wiring supplies. The Atlanta Federal Penitentiary ordered crossarms and pole line hardware amounting to $2,000 and the Nashville, Chattanooga & St. Louis Railway ordered $1,000 worth of bare copper for use on its signal system. Construction projects are as follows:

Lynchburg, Va., contemplates an aircraft lighting system and beacon lamps at its proposed municipal airport. William W. McElrath, Richmond, Va., engineer, will prepare plans for a projected rayon mill in Virginia to cost $4,000,000. The Homer Laughlin China Company, Newell, W. Va., plans an addition to cost $1,500,000. The Kentucky & West Virginia Power Company, Hazard, Ky., plans an addition to its power plant at Lothair, Ky., to cost $500,000. The Consolidated Coach Corporation, Lexington, Ky., will build a machine and service shop to cost $125,000. The Palmtree Mutual Lighting Company, Lawndale, N. C., recently organized, plans a transmission line and substation facilities, to cost $25,000. The Draper Corporation, Hopedale, Mass., will build an assembling plant and distributing branch for cotton mill machinery at Spartansburg, S. C., to cost $100,000. The Union Bleachery, Greenville, S. C., will build an addition to cost $240,000. The Paepcke Corporation, Chicago, plans a wood pulp mill at Greenville, Miss., to cost $150,000. The Alabama Power Company, Birmingham, Ala., plans a power substation in the Wills Creek district, Gadsden, Ala., to cost $30,000. Sheffield, Ala., plans an ornamental lighting system.

Sales at High Level in Eastern District

Sales are developing to a high point in the Eastern district and a record volume of business for several primary items is in sight. The advance in the price of copper is reflecting an anticipated increase in quotations for industrial motors and March account in this line is expected to reach new high levels. Sizes ranging from 5- to 30-hp. motors are selling well in different industries, while a manufacturer of units up to 200 hp. reports a strong demand from iron and steel mills and other interests. A New Jersey maker has received a commitment for a number of heavy type motors for a new steel tube mill in the Pittsburgh district. A mechanical laundry in New Jersey has ordered a motor-generator set to cost $25,000. Fractional-horsepower motors are receiving attention and the outlook for sales is good. A manufacturer of washing machines in northern New York has placed a contract for units of this kind to an amount of $47,000. Refrigerator manufacturers are in the market for motor requirements and several sizable contracts are soon to be placed.

Prime movers are recording good business both from central-station and industrial account. A power company in Nebraska has ordered a turbine unit from a New York maker to cost $375,000. A copper mining company in the West has inquiries out for a 1,500-kw. turbo-generator, with switchboard and accessory apparatus, and will soon place a commitment. Substation equipment is rounding out excellent totals with a large volume of orders still to be placed. A central station in West Virginia has contracted for transformers to cost $35,000, a metropolitan power company has placed a commitment for similar equipment to cost $100,000, while another central station has ordered transformers and network protectors to the sum of $175,000. A power company in Ohio has given a contract for like apparatus to cost $25,000. Business in oil circuit breakers is active and inquiries are developing to a high level. A central station in Virginia has contracted for equipment of this kind to an amount of $40,000, while another utility company in Kentucky has ordered to the sum of $25,000. A manufacturer of wire and cables reports improved account, with early March orders indicating a record month. A metropolitan power company has placed an order for low-voltage paper-wound cable to cost $40,000. Street-lighting equipment shows improvement. Construction projects are as follows:

The New York Power & Light Corporation, Albany, contemplates a hydro-electric development at Palmer Falls, near Palmer, N. Y., to cost $3,000,000. The New York Air Terminals, Inc., New York, recently organized, plans an airport near Secaucus, N. J., to cost $2,000,000. The Huguet Silk Company, Hornell, N. Y., plans an addition to cost $100,000. The Paramount Brick Works, Inc., Brooklyn, plans a plant in the Bronx, New York, to cost $80,000. Our Lady of Lourdes Memorial Hospital, Binghamton, N. Y., will build a power plant in connection with institutional building, the project to cost $475,000. Buffalo, N. Y., will receive bids until March 21 for field lighting, highway lighting and primary power at the municipal airport. The Philadelphia & Reading Coal & Iron Company, Philadelphia, will build a group of electric-operated coal breakers each to cost $1,000,000. F. G. Vogt & Sons, Inc., Philadelphia, plan a meat-packing plant to cost $1,000,000. The Lansdale Brick Company, Lansdale, Pa., will build a plant to cost $100,000. The Spicer Manufacturing Corporation, Pottstown, Pa., will build an addition to its automobile equipment and axle plant to cost $300,000. The Duquesne Light Company, Pittsburgh, will make extensions in the lighting system at Midland, Pa. The Department of Commerce, Washington, will receive bids until April 1 for electric airway beacons for the Chattanooga-Nashville section of the Atlanta-Chicago Airway (Proposal 20625). The General Purchasing Officer, Panama Canal, Washington, will receive bids until March 27 for electric cord, transformer, outlet boxes, sockets and other supplies (Panama Schedule 1948.)

Industrial Orders Lead in New England

Orders for industrial equipment mark the trend in the New England district. Line material inquiries are increasing and street lighting projects are voted by many municipalities. Central-station equipment negotiations presage many interesting orders in the early spring. Small motor sales lead in the market

volume, the sales from one manufacturer reaching over $40,000. Textile mills are planning new processes which require new installations and recently an order for four 50-hp. motors was received from a weaving mill. Switch and control orders are accompanying the buying of motors and the trend for scheduled material is encouraging. Line material is being quoted, while orders for insulators are numerous and several projects of considerable extent are being considered, among them a line 12.7 miles long to cost $253,000. A distributor reports early inquiries for hardware, poles and wire to be used in linking up a number of substations in northern New England. Central-station equipment orders cover small lots of scheduled material, but the trend is steady. One manufacturer estimates orders amounting to over $2,000,000 will be placed this spring. Construction projects are as follows:

The New England Power Company, Worcester, Mass., will build a power plant at Millbury, Mass., to cost $250,000. The Bridgeport Brass Company, Bridgeport, Conn., will build an addition to cost $80,000.

Railroad Purchasing Heavy in Middle West

Business in the Middle West section continues on a generally satisfactory basis. Industrial activity is particularly gratifying with many announcements of increases to plant facilities. The steel industry is in a remarkably good condition, while automotive production is scheduled at a high rate. Reports that the Illinois Central Railroad has ordered equipment to cost $1,000,000 and that the Southern Pacific Railroad has purchased 21,840 tons of structural steel are looked upon as favorable indications of general prosperity. A slight acceleration of building activity is noticeable. The utility companies are getting under way with their spring extension work. The demand for distribution equipment, due to increased prices, has been unusually large, some manufacturers of transformers booking orders for a normal year's business at this time. There has been a good demand for wire and cables, one utility company placing an order valued at $250,000 for 750,000-circ.mil and 1,000,000-circ.mil, 43-kv. paper and lead cable. Jobbers' sales continue to show improvement. Construction projects are as follows:

The Michigan Public Service Company, Ludington, Mich., plans additions in transmission lines and substations to cost $30,000. The Consolidated Paper Company, Monroe, Mich., plans an addition to cost $200,000. The Shaw-Walker Company, Muskegon, Mich., will build an addition to its steel office equipment manufacturing plant to cost $150,000. The Evans Fibre Box Company, Chicago, plans an addition to cost $100,000. The Cellosilk Manufacturing Company, Chicago, manufacturer of transparent wrapping materials, will build a plant at Barrington, Ill., to cost $150,000. The Texcrete Face Brick Company, Chicago, plans a plant to cost $75,000. The International Harvester Company, Chicago, plans a plant at Fort Wayne, Ind., to cost $100,000. The Inland Steel Company, Chicago, plans an addition to its mill at Indiana Harbor, Ind., to cost $2,000,000. The Highland Body Manufacturing Company, Cincinnati, Ohio, will build an addition to its automobile body plant to cost $60,000. The Republic Iron & Steel Company, Youngstown, Ohio, plans a laboratory for steel tubing and electric welding to cost $100,000. The Hoover Suction Sweeper Company, Canton, Ohio, plans an addition to cost $250,000. The Cincinnati Milling Machine Company, Cincinnati, Ohio, plans an addition to its machine tool works to cost $85,000. The White Motor Company, Cleveland, will erect a motor truck service building to cost $200,000. The Western Public Service Company, Scottsbluff, Neb., plans extensions in transmission lines at Sydney, Neb., and vicinity. Ottumwa, Iowa, plans a municipal hydro-electric plant to cost $750,000. The Iowa Railway & Light Corporation, Cedar Rapids, Iowa, contemplates a transmission line and substation facilities at Tipton, Iowa, and vicinity.

Buying Light But Prospects Active on Pacific Coast

Power company purchasing features a rather poor week on the Pacific Coast and includes such items as one carload of $\frac{3}{8}$-in. double galvanized guy strand, 10,000 each of brass lugs and copper sleeves, one carload of assorted bolts, deadends and thimbles and 10,000 lb. of No. 6 soft bare copper wire. The Pacific Gas & Electric Company has ordered two carloads of weatherproof wire and four carloads of bare copper wire for various reconstruction work. The San Joaquin Light & Power Corporation has bought 500 poles of 8-in., 45-ft. size valued at $9,000 for emergency construction. Pole orders are numerous, including three carloads of 6-in., 20-ft. for the Southern mines territory, $2,500 worth of 7 and 8-in., 35 and 40-ft. for the Mendocino district and $2,000 worth of sizes 30 to 40 ft. for Gridley. Street lighting jobs cover a $36,000 award for a downtown job in Stockton. A Porterville projected installation estimated at $26,000, a 34-light installation for Ukiah, 59 standards for Redwood City and 88 standards for Huntington Beach. A new turbo-electric-driven Coast Guard cutter costing $3,000,000 is to be constructed on the coast, a $1,250,000 country club hotel is planned for Marin County and a $750,000 hotel resort for Arrowhead Lake. The San Francisco Board of Education budget for 1929 includes $3,500,000 for junior high schools. Machinery manufacturers report a very poor week except for distribution transformers, one manufacturer aggregating 400. A Fresno irrigation district is in the market for 75- and 100-hp. motors.

Last week central-station buying was light in the Puget Sound district, but there are orders of consequence in immediate prospect. Industrial buying was light and scattered, although inquiries reported are numerous. Sales of importance reported included fifteen motors from 800 hp. down to the Puget Sound Power & Light Company for auxiliary equipment for the Shuffleton steam plant and approximately $4,000 for switchboards for the Boeing Airplane plant. Specifications for about $15,000 worth of switchboards for the Shuffleton steam plant was reported out. The city of Tacoma on April 11 will open bids for construction of unit No. 2 of the Lake Cushman hydro-electric project, involving a diversion dam and costing about $3,000,000. Sandpoint, Idaho, on April 5 will vote on a $300,000 bond issue for a municipal hydro-electric plant. The Eastern Oregon Development Company plans building a 20-mile, 66,000-volt transmission line to mines near Keating, Ore. Everett, Wash., has opened bids for a $37,000 street lighting system. Plans have been announced for the first unit of the pulp and paper plant in Everett costing $4,500,000 for the San Juan and Fidalgo Pulp and Paper companies, operating in Bellingham and Anacortes; the $300,000 sawmill planned for Peshastin, the first unit of the $250,000 briquetting plant for Seattle and the Pacific Coast Terminals, Inc., of Tacoma $300,000 cold storage plant. Construction projects are as follows:

The Southern Sierras Power Company, Riverside, Calif., plans a transmission line from Truckee to Portola, Calif. The Consumers Ice Company, Sacramento, Calif., plans an addition to its ice-manufacturing plant to cost $60,000. The F. E. Booth Company, Pittsburgh, Calif., plans a fish-canning plant to cost $200,000. Los Angeles, San Mateo and Chula Vista, Calif., plan ornamental lighting systems. Swift & Company, Chicago, plan a cold storage and refrigerating plant addition to its meat-packing plant at Modesto, Calif., to cost $80,000. The Southern California Edison Company, Los Angeles, will build a power substation at San Dimas, Calif., to cost $130,000. The Sparkletts Bottled Water Corporation, Los Angeles, plans a bottling plant to cost $100,000. The Edward Hines Lumber Company, Chicago, plans a mill at Burns, Ore., to cost $1,000,000. The Portland Electric Power Company, Portland, Ore., plans an equipment storage and distributing plant at Salem, Ore., to cost $200,000. Tacoma, Wash., plans a transmission line to cost $85,000. The Northern Pacific Railway Company, St. Paul, Minn., will build steel car shops at Laurel, Mont., to cost $100,000. The Southern Colorado Power Company, Pueblo, Colo., plans a transmission line to cost $40,000. The Norton Dairy Company, Inc., Phoenix, Ariz., plans a milk and dairy plant to cost $100,000. The Central Arizona Light & Power Company, Phoenix, Ariz., plans a power substation to cost $30,000. The Monarch Lead Mining Company, Chloride, Ariz., plans a milling plant to cost $200,000. The New Mexico Public Service Company, Farmington, N. M., plans a steam-operated electric power plant to cost $100,000.

Apparatus Sales in Good Volume in St. Louis District

One of the large manufacturers in the St. Louis district reports that since the first of March orders for medium-sized apparatus have increased in number as well as in volume. Central stations are buying steadily. Orders reported placed are a switchboard for a local manufacturing company costing $30,000, a lot of double-current crane motors for one of the larger glass com-

panies costing $10,000, a battery of electric condensers for a central station costing $10,000, oil well equipment for a Kansas company costing $4,000, a lot of motors for oil well pumping costing $7,000 to an Oklahoma company, equipment for an oil pipe line pumping station costing $15,000 and three different orders for high-tension switching equipment costing $4,000 each. Construction projects are as follows:

The Guardian Aircraft Corporation, St. Louis, plans a plant unit to cost $175,000. The Springfield Gas & Electric Company, Springfield, Mo., plans extensions in the transmission lines in Greene County. The Commissioner of Indian Affairs, United States Indian Service, St. Louis, will receive bids until April 12 for electrical supplies. Columbia, Mo., is asking bids until April 3 for equipment for the municipal power plant. The Batesville White Lime Company, Batesville, Ark., plans a plant to cost $80,000. The National Portland Cement Company, Dallas, Texas, plans a plant at Houston, Texas, to cost $120,000. Galveston, Texas, plans an ornamental lighting system. The Standard Oil Company of Louisiana, New Orleans, La., plans a refining plant at Baton Rouge, La., to cost $500,000.

Activities of the Trade

Western Electric Company Has Good Year

Sales of the Western Electric Company for 1928 greatly exceeded those of any previous year. According to President Edgar S. Bloom, net earnings surpassed those in 1927, notwithstanding important price reductions. Appropriations for increasing manufacturing facilities also exceeded those of any previous year.

Total sales for the year amounted to $287,931,396, which is an increase of 13.5 per cent over the previous year. The volume of business handled shows an even larger increase, namely, 22 per cent, the difference being due to lower prices. These price reductions amounted to upward of $19,000,000 on the 1928 volume of business and were largely the result of improved methods and processes, increased efficiency of personnel and further introduction of labor-saving machinery. Net earnings amounted to $22,023,282.

Owing to increased demands for long-distance telephone cable facilities, the company showed an increase of 59 per cent in cable production, making a total of over 7,000,000 conductor-feet of cable during the year. This increase in factory production during 1928 is paralleled by increases of from 33 to 78 per cent in other important types of telephone equipment.

THE NEW DEPARTURE MANUFACTURING COMPANY, Bristol, Conn., manufacturer of New Departure ball bearings, announces a large factory extension program. The new additions will add 250,000 sq.ft. of floor space to the main works at Bristol and 80,000 sq.ft. to the Meriden plant. The new building at Bristol will be 404 ft. long and 128 ft. wide and at the Meriden plant the extension will be 220 ft. x 106 ft.

THE CHICAGO-JEFFERSON FUSE & ELECTRIC COMPANY, 1500 South Laflin Street, Chicago, announces that at the annual meeting of its stockholders it was decided to change the name of the company to the Jefferson Electric Company.

CUTLER-HAMMER, INC., Milwaukee, manufacturer of electric controlling devices, announces that P. S. Jones, formerly manager of its Pittsburgh office, has become manager of its New York district office. He succeeds C. W. Yerger, who left the company to accept a position with the Hanson-Van Winkle-Munning Company of Matawan, N. J. T. S. Towle, formerly a sales engineer of the Pittsburgh office, has become manager at Pittsburgh, and G. E. Hunt has been placed in charge of distributors' sales for the company.

A. W. French & Company and Blaw-Knox Company Merge

A merger between A. W. French & Company of Chicago and the Blaw-Knox Company of Pittsburgh has been announced. A. W. French & Company are manufacturers of the well-known "Ord" concrete and asphalt road-finishing machine, the "Nu-Method" finish grader, the new ball wagon grader and similar products.

The personnel and policies of A. W. French & Company will continue as heretofore and its plant and sales organization will function as a separate division of the Blaw-Knox Company.

Electric Storage Battery Shows Gain

The earning statement for the Electric Storage Battery Company and the Willard Storage Battery Company shows gross sales for the year ended December 31 last of $46,219,193, against $45,640,291 for the previous year, which is a gain of 1.3 per cent. Operating costs amounted to $40,087,641 and the net profit after allowance for the federal income tax was $6,335,085. Total assets at the end of 1928 amounted to $47,084,530, against $44,908,097 for the previous year.

Westinghouse Electric Reports Best Year in Company's History

THE business of the Westinghouse Electric & Manufacturing Company during the year 1928 was the best for any twelve months in its history, according to the company's annual report, which was made public recently. Sales billed for the year were $189,050,302 and net income was $20,814,940, which figures exceed previous records by $3,500,000 and $2,700,000, respectively. The net income per share of stock (preferred and common) was $8.78, or 17.5 per cent on the par value, which compares with $6.59, or 13.2 per cent, for the period covered by the last annual report. Both classes of stock are now receiving annual dividends of $4 per share of $50 par value.

Owing to a change in the fiscal year, which now ends December 31, instead of March 31 as heretofore, the present report covers officially only the nine-months period extending from April 1 to December 31, 1928, but the figures above given are for the entire year of 1928 in order to provide a basis for comparison with previous full fiscal years.

The company's total current assets are given as $135,679,223, a gain of over $13,000,000 in nine months, and its total current liabilities are $17,000,000. The surplus is now $67,000,000, a gain of $10,000,000 in nine months.

The value of unfilled orders on December 31, 1928, was approximately $47,000,000. During the nine-months period the value of orders received exceeded by almost $20,000,000 that of the same period in 1927, due largely to the increase in demand for radio products and industrial motor apparatus.

The physical properties of the company have been maintained in excellent operating condition, according to A. W. Robertson, chairman, and E. M. Herr, president, who sign the report. The only important additions are at East Springfield, Mass., to accommodate the increase in demand for radio products, and at Trafford, Pa., for the manufacture of products of micarta, non-metallic material in large demand for insulation, gears, pulleys, airplane propellers, radio panels and parts, etc.

The company's continued development and expansion of its operations into new and related lines, it is stated, will result in a diversification of activities, the effect of which should be to make the fluctuations in production and sales less pronounced. The company's research engineers are daily searching for—and finding—new materials, new processes and new applications for electrical equipment. By their efforts, improvements are being made in apparatus for generating stations, for transmission systems and in appliances for the home and in equipment for industry and transportation. The stated objective is a

closer approach to a high ideal of service—the lowering of costs and the perfection of electrical products.

TIMKEN ROLLER BEARING EARNINGS.—Net profits of the Timken Roller Bearing Company for the year ended December 31 last amounted to $13,730,-145 after depreciation, interest and federal taxes, which is the equivalent of $11.43 a share. This compares with $9,564,397, or $7.95 a share, in 1927. Total manufacturing profits of the company amounted to $20,378,191, against $14,995,892 in 1927.

THE WESTINGHOUSE LAMP COMPANY, 150 Broadway, New York City, announces the appointment of Fred S. Kinsey, formerly manager of its company at Philadelphia, as manager of the Middle Western division of its company with headquarters in Chicago, effective as of March 31. He will be succeeded by George B. Mackey, formerly miniature lamp specialist in the Philadelphia district.

THE RADIO CORPORATION OF AMERICA, Woolworth Building, New York City, announces that its Eastern district sales office will be moved to new and larger quarters in the 251 Fifth Avenue Building, New York City, about March 22, according to J. L. Ray, vice-president and general sales manager.

THE WAGNER ELECTRIC CORPORATION, St. Louis, announces that K. G. Baker has joined its Cincinnati sales force. Mr. Baker has previously been connected with the Century Electric Company and the Fulton Iron Works, both of St. Louis.

New Equipment Available

Concentrating Type Lighting Units

A new high narrow bay lighting unit has been developed by the Benjamin Electric Manufacturing Company of Chicago for locations where a powerful light mounted well above the working plane is required. The unit, which may be mounted from 15 to 80 ft. above the working plane, concentrates the largest part of its light output directly beneath the unit, with a minimum amount of light in the upper areas or on side walls of the room.

The deep bowl concentrating type reflector is made of aluminum with aluminum-oxide finish, which resists corrosion and is said to insure a permanent surface of maximum reflecting value. The unit is light in weight and easy to install. A two-piece copper screw thread construction allows the separation of reflector and hood for easy wiring. The heavy rolled copper screw thread on the neck of the reflector screws into the thread on the hood to provide firm attachment. Hoods are furnished for either pendent or outlet box attachments. Three sizes of lamps, 750, 1,000 and 1,500 watts, may be used.

Peerless Wire Insulation Remover

The type KP Peerless magnet wire insulation removing machine has been designed by the Electric Service Supplies Company of Philadelphia for the purpose of reducing shop costs in removing insulation or skinning the leads of armature coils. The leads are brought in contact with a special brush revolving at a proper speed to remove the insulation without damage to the copper wire.

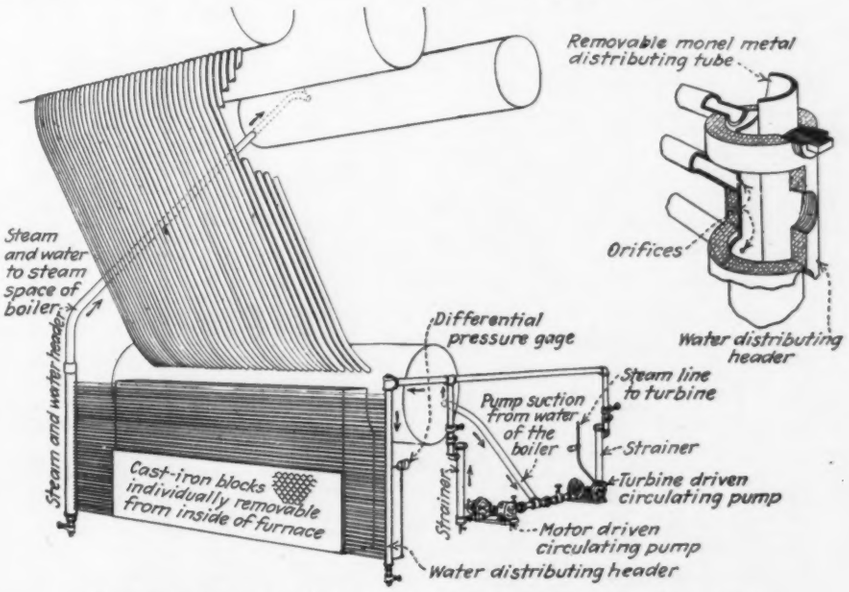
The new machine is self-contained for floor mounting, being supplied with a cast-iron pedestal, the revolving parts being properly guarded. A spout is provided in this guard for disposal of the insulating material removed. Pressure is applied to force the wire into contact with the brush and is controlled through a foot-operated treadle. The net weight of the outfit complete is approximately 160 lb.

Riley-La Mont Waterwall

As an alternative to natural boiler circulation and large diameter tubes as used with most water-wall construction at the present time, the Riley-La Mont water wall is based upon the use of forced circulation and is constructed of small diameter flexible tubes in conjunction with small headers, which it is claimed by the company insures positive and proper distribution throughout the entire system.

Positive circulation is maintained in a single direction by means of a centrifugal pump of proper characteristics and by distributing orifices incorporated to regulate the flow of water according to specific requirements. Water enters the circulating pump by gravity from the drum of the boiler, its pressure being increased by the pump from 15 to 40 lb., depending on the rate of heat absorption of the water wall. This water enters a header supplied with distributing orifices which meter the proper quantities of water supplied to each tube. The capacity of these orifices is such that the quantity of water forced into each tube is several times the quantity of water which will be evaporated under the condition of maximum heat absorption. This quantity of water, however, is insufficient to fill the tube. As heat is absorbed in the tube, part of the water is turned into steam, which compared to the quantity of water is very great in volume. The steam produced cannot find its way out of the orifice end of the tube so that it must therefore leave the other end of the tube, entering the header which is connected into the steam face of the boiler.

The tubes are long compared with their cross-sectional area, so that the steam generated produces exceedingly high velocities in the tubes; the steam from the header, moving at great velocity, carries with it the excess water which entered through the orifices. With such positive circulation steam binding under these conditions is impossible, it is claimed. With this construction the tubes may be installed vertically, horizontally or at any desired angle with the flow either up or down, and the tubes can also be bent at any angle to avoid structural obstacles and furnace openings.


Removable monel metal distributing tube
Orifices
Steam and water to steam space of boiler
Steam and water header
Differential pressure gage
Water distributing header
Steam line to turbine
Pump suction from water of the boiler
Strainer
Turbine driven circulating pump
Strainer
Motor driven circulating pump
Cast-iron blocks individually removable from inside of furnace
Water distributing header

Construction applied to the bridge wall of a bent tube boiler

The small sectional view shows the water header with the small distributing orifices.

Electrical Patents

Announced by U. S. Patent Office

(Issued February 26, 1929)

17,222 (reissue). BOX-SUPPORTING EAR; C. Newman, New York, N. Y. App. filed June 15. 1928.

1,703,085. MEASURING APPARATUS; O. A. Ankersmit, Delft, Netherlands. App. filed Jan. 11, 1926.

1,703,087. DYNAMO-ELECTRIC MACHINE; C. L. Daun and P. E. Keller, Milwaukee, Wis. App. filed Aug. 30, 1926.

1,703,110. ELECTRICAL RECTIFIER SYSTEM; J. Jonas, Baden, Switzerland. App. filed Jan. 26 1927.

1,703,131. ELECTRICAL DISTRIBUTION SYSTEM; H. R. Woodrow, Brooklyn, N. Y. App. filed Dec. 1, 1925.

1,703,146 and 1,703,147. RECTIFIER ALARM SYSTEM; W. H. T. Holden, Brooklyn, N. Y. App. filed May 5, 1924.

1,703,191. DYNAMO BRUSH; N. R. Haas, Dayton, Ohio. App. filed April 14, 1925.

1,703,207. REGULATOR; L. M. Perkins, Anderson, Ind. App. filed May 5, 1927.

1,703,224. LIGHT SIGNAL FOR RAILWAYS AND THE LIKE; W. Challis, Amsterdam Common, and C. H. W. Edmonds, London, England. App. filed Oct. 22, 1924.

1,703,233. BATTERY INDICATOR; A. B. Hall and J. H. Quilhot, New York, N. Y. App. filed April 13, 1927.

1,703,235. PRESSURE-CONTROL SWITCH; D. P. Heath, Peoria, Ill. App. filed July 22, 1926.

1,703,236. FUSE; J. H. Hickey, San Francisco, Calif. App. filed Oct. 25, 1926.

1,703,242. PRODUCTION OF SINGLE AND MULTIPHASE ALTERNATING CURRENTS; S. A. Kukel, Moscow, Russia. App. filed June 2, 1924.

1,703,279. LIGHTING FIXTURE OF THE ELECTRIC-CANDLE TYPE; G. J. Meuer, Milwaukee, Wis. App. filed May 25, 1927.

1,703,280. DIRECTIONAL STABILIZER; N. Minorsky, Belmar, N. J. App. filed Sept. 21, 1922.

1,703,317. AUTOMATIC STEERING DEVICE; N. Minorsky, Lansdowne, Pa. App. filed April 8, 1925.

1,703,319. COMBINED TIMER AND DISTRIBUTOR; H. R. Patterson, Poughkeepsie, N. Y. App. filed July 21, 1920.

1,703,325. TERMINAL CLIP FOR CABLE ENDS; B. M. Smarr, Detroit, Mich. App. filed March 25, 1925.

1,703,345. PHASE-SEQUENCE INDICATOR; O. A. Knopp, Oakland, Calif. App. filed Sept. 16, 1927.

1,703,353. CIRCUIT INTERRUPTER; F. Natalis, Berlin-Charlottenburg, Germany. App. filed Jan. 24, 1928.

1,703,357. HEAT-CONTROLLING APPARATUS; A. H. Osgood, Auburn, Wash. App. filed Feb. 20, 1926.

1,703,387. MEANS FOR MEASURING THE LENGTH, SPEED, AND CONTINUITY OF WEBS; C. E. Braun, Camas, Wash. App. filed July 27, 1922.

1,703,408. TRANSFORMER; F. S. Smith, Philadelphia, Pa. App. filed Sept. 14, 1920.

1,703,409. HIGH-VOLTAGE TERMINAL; F. S. Smith, Philadelphia, Pa. App. filed March 2, 1921.

1,703,410. ELECTRIC TRANSFORMER; F. S. Smith, Philadelphia, Pa. App. filed March 7, 1922.

1,703,420. MAGNETO; F. I. Gibson, Brownsville, Vt. App. filed Dec. 24, 1925.

1,703,439. DEVICE FOR PROTECTING ELECTRIC CIRCUITS; O. Dreyer, Essen-on-the-Ruhr, Germany. App. filed Jan. 20, 1926.

1,703,486. ELECTROMAGNETICALLY-OPERATED APPARATUS; B. W. Jones, Schenectady, N. Y. App. filed June 6, 1924.

1,703,487. SYSTEM OF MOTOR CONTROL; B. W. Jones, Schenectady, N. Y. App. filed Oct. 20, 1922.

1,703,524. LUMINOUS TUBE; R. Grandjean, Courbevoie, France. App. filed Aug. 1, 1925.

1,703,532. IMMERSION HEATER; L. P. Hynes, Albany, N. Y. App. filed Dec. 6, 1924.

1,703,533. COMPENSATED ASYNCHRONOUS MOTOR; F. Kade, Kiel, Germany. App. filed Jan. 29, 1925.

1,703,541. SPOT-WELDING APPARATUS; W. H. Pierson, Detroit, Mich. App. filed Nov. 1, 1926.

1,703,551. HAIR-DRYING ATTACHMENT FOR VACUUM CLEANERS; W. M. Singer, Glendale, Calif. App. filed May 9, 1928.

1,703,588. MACHINE FOR WELDING WHEELS TO RIMS; J. W. Meadowcroft, Philadelphia, Pa. App. filed Dec. 28, 1926.

1,703,590. ELECTRICAL TIME SWITCH; S. W. Neldner, Milwaukee, Wis. App. filed Feb. 4, 1926.

1,703,595. ELECTRODE HOLDER FOR ARC LAMPS; J. R. Quain, London, England. App. filed Aug. 26, 1927.

1,703,626. LAMP-BULB SOCKET; E. A. Kuen, Cincinnati, Ohio. App. filed Feb. 14, 1925.

1,703,631. SEPARABLE ATTACHMENT PLUG; G. J. Meuer, Milwaukee, Wis. App. filed June 25, 1923.

1,703,640. ELECTRIC HEATING ELEMENT AND METHOD OF MANUFACTURING SAME; A. Schmidt-Predari, Weimar, Germany. App. filed Aug. 5, 1926.

1,703,663. ELECTRIC SWITCH; H. J. L. Frank, Detroit, Mich. App. filed Jan. 16, 1924.

1,703,680. ELECTROLYTIC CONDENSER; H. N. Miller, Chicago, Ill. App. filed April 9, 1927.

1,703,683. SPOT-WELDING MACHINE; M. W. Moesta, Detroit, Mich. App. filed Oct. 17, 1927.

1,703,691. STOP SIGNAL; C. L. Post, Chicago, Ill. App. filed Oct. 2, 1922.

1,703,698. ELECTRIC LAMP; J. F. Whelan, Philadelphia, Pa. App. filed Dec. 6, 1927.

1,703,711. THERMOSTATIC PLUG CONTROL FOR ELECTRIC IRONS, ETC.; C. G. Anderson, Boston, Mass. App. filed Sept. 7, 1926.

1,703,720. CANOPY SWITCH; P. E. Burns, Syracuse, N. Y. App. filed March 9, 1927.

1,703,724. ELECTRIC CONTROL SWITCH; C. C. Crispen, Harrisburg, Pa. App. filed May 7, 1924.

1,703,727. ROTOR OF MERCURY BATH ELECTRICITY METERS; S. Z. de Ferranti, Hollinwood, England. App. filed April 14, 1925.

1,703,735. DEMOUNTABLE BATTERY; W. E. Holland, Philadelphia, Pa. App. filed March 25, 1922.

1,703,768. TROLLEY; A. L. Henry and G. S. Moore, Indianapolis, Ind. App. filed Feb. 16, 1928.

1,703,797. POWER-TRANSMISSION LINE; T. Varney, Sewickley, and M. E. Noyes, Dormont, Pa. App. filed March 12, 1923.

1,703,798. SELENIUM CELL; H. Thirring, Vienna, Austria. App. filed July 9, 1926.

1,703,810. ROTATING FIELD MAGNET FOR TURBOGENERATORS; O. T. Bláthy, Budapest, Hungary. App. filed Jan. 14, 1927.

1,703,822. POWER-OPERATED CONTROL APPARATUS FOR TRAFFIC-CONTROLLING SYSTEMS; W. K. Howe, Rochester, N. Y. App. filed March 18, 1927.

1,703,827. ELECTRODE; J. G. H. Liebel, Cincinnati, Ohio. App. filed Aug. 22, 1927.

1,702,837. RELAY; S. M. Day, Rochester, N. Y. App. filed April 9, 1920.

1,703,853. DRY-SPOT INSULATOR; R. Gould, New York, N. Y. App. filed April 29, 1927.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Montreal, Canada (No. 36,712), of an amplifier for public speaking and a loudspeaker.

A sole agency is desired in Buenos Aires, Argentina (No. 36,759), for dry batteries and flashlights.

Purchase and agency are desired in Naples, Italy (No. 36,723), for storage batteries.

Purchase is desired in Prague, Czechoslovakia (No. 36,709), of burglar alarm equipment for banks.

An agency is desired in Cologne, Germany (No. 36,716), for coffee grinders, meat slicers, and other machines for grocery stores.

An agency is desired in Johannesburg, South Africa (No. 36,718), for fireless cookers and another (No. 36,717), for electric dish and bottle washers for bars.

Purchase is desired in Quebec, Canada (No. 36,708), of electric hand and face dryers.

Purchase or agency is desired in Barcelona, Spain (No. 36,770), for electric fans and ventilators.

An agency is desired in Winnipeg, Canada (No. 36,714), for household electrical appliances and electric portable tools, and another (No. 36,715), for vacuum brushes and small cleaners.

Purchase and agency are desired in Quebec, Canada (No. 36,811), for therapeutic sunlight lamps.

An agency is desired in Toronto, Canada (No. 36,713), for therapeutic lighting equipment.

An agency is desired in Vienna, Austria (No. 36,719), for electric refrigerators.

Purchase or agency is desired in Toronto, Canada (No. 36,710), for electrical restaurant equipment.

An agency is desired in Turin, Italy (No. 36,778), for electric lacquer sprayers.

New Trade Literature

PORCELAIN AND ELECTRICAL SUPPLIES. — Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., is distributing a general catalog that covers the full range of the company's porcelain and electrical supplies. The company also has issued a special "Alabax" porcelain lighting fixture manual and a folder suitable for dealer imprint and general distribution.

ELECTRIC RANGES, AIR HEATERS, ETC.—Catalog No. Y600 issued by the Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, describes its "Hotpoint" electric ranges, air heaters, hotplates and water heaters. The catalog contains complete specifications and illustrations of each unit. Accompanying the catalog are sheets containing wholesale and suggested retail prices covering ranges and water heaters.

SYNCHRONOUS MOTORS.—A bulletin entitled "The Most Efficient Drive for Rubber Mills" has been issued by the Electric Machinery Manufacturing Company, Minneapolis. It contains illustrations showing the installation of the E-M synchronous motors in the various rubber companies.

ANCHORS.—The W. N. Matthews Corporation, 3720 Forest Park Boulevard, St. Louis, is distributing a pamphlet covering its new "Scrulix" anchors.

CONNECTORS.—A bulletin issued by the Burndy Engineering Company, Inc., 10 East 43d Street, New York City, contains illustrations showing the operation of its "Anaconda" seamless connectors.

FLASHERS, CONTROLS, ETC.—Bulletin No. 47 issued by the Reynolds Electric Company, 2650 West Congress Street, Chicago, describes and illustrates the "Reco" products, including flashers for electric signs and displays, color lighting equipment, traffic controls for stop-and-go signals, timers for special contacting work, motor-driven dimmers, motors of sizes 1/20 to ¼ hp. for direct current and alternating current and reflectors for poster and bulletin boards.

ELECTRIC VENTILATOR. — Landers, Frary & Clark, New Britain, Conn., have issued a pamphlet describing and illustrating the new "Universal" electric ventilator.

TWISTED SERVICE CABLE.—A booklet has been issued by the Okonite Company, Passaic, N. J., which covers its twisted service cable. It contains complete descriptions of house service and street lamp connections and shows why this cable is needed and how it is used and installed. A table of weights and sizes is included.

TELEMETERING EQUIPMENT.—Bulletin GEA-1089 issued by the General Electric Company, Schenectady, N. Y., describes and illustrates its rectified-current type automatic telemetering equipment.

POWER AND DISTRIBUTION TRANSFORMERS.—The Wagner Electric Corporation, 6400 Plymouth Street, St. Louis, has issued bulletin No. 161, which contains instructions for the installation and operation of power and distribution transformers. The bulletin also contains details regarding the construction of the transformers and covers such subjects as the location of transformers, their storage, handling and installation, drying core and coils, drying and testing oil and proper operating temperatures.

FRAMES.—Bulletin No. 83-C issued by the Revolvator Company, 336 Garfield Avenue, Jersey City, N. J., describes and illustrates its hinged and telescopic frames which are adaptable to all revolvators and portelators.

METERS.—The Lincoln Meter Company, Inc., Springfield, Ill., has issued a bulletin covering the Lincoln maximum demand meters. The bulletin contains illustrated descriptions of the various Lincoln models and a technical discussion of the Lincoln's principle of operation.

TRANSFORMERS AND ACCESSORIES. —Circular No. 1807 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covers its network transformers and accessories. The circular is well illustrated and contains complete descriptions of the transformers built for secondary alternating-current network systems.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Water Power in the West and South: Population Massed in North and East

OF THE nine geographical divisions into which government reports divide the country, the Pacific has the largest amount of developed water power, according to a recent report of the Division of Power Resources of the U. S. Geological Survey. The total for the entire country as of Jan. 1, 1929, was 13,571,530 hp. Of this, 3,262,909 hp., or 24 per cent, was in the Pacific States, that had 1,788,670 hp. in the fall of 1921.

Next in order of present development come the South Atlantic States, now reported with 2,595,304 hp., against 1,081,509 hp. at the earlier date. In slightly more than seven years, therefore, these two sections have increased their developed water power by nearly 3,000,000 hp.; somewhat more than half of it in the eastern and a little less in the western.

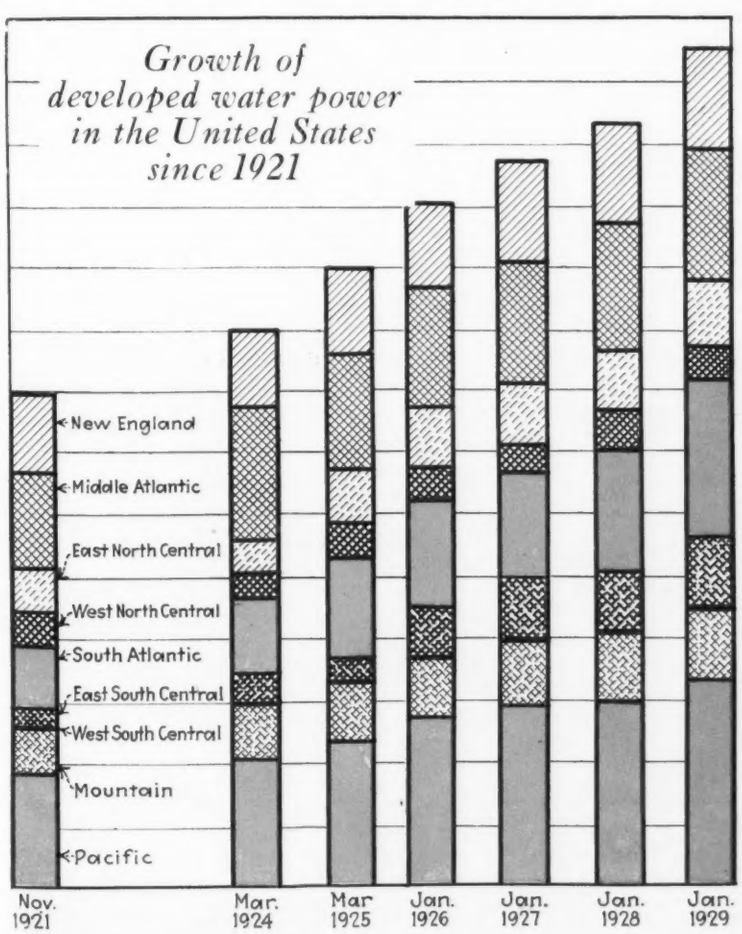
These are followed by the Middle Atlantic division, with 2,122,999 hp.; New England, 1,653,654 hp.; the Mountain States, 1,140,108 hp.; East South Central, 1,118,765 hp.; East North Central, 1,075,660 hp.; West North Central, 555,049 hp.; West South Central, 47,082 hp.

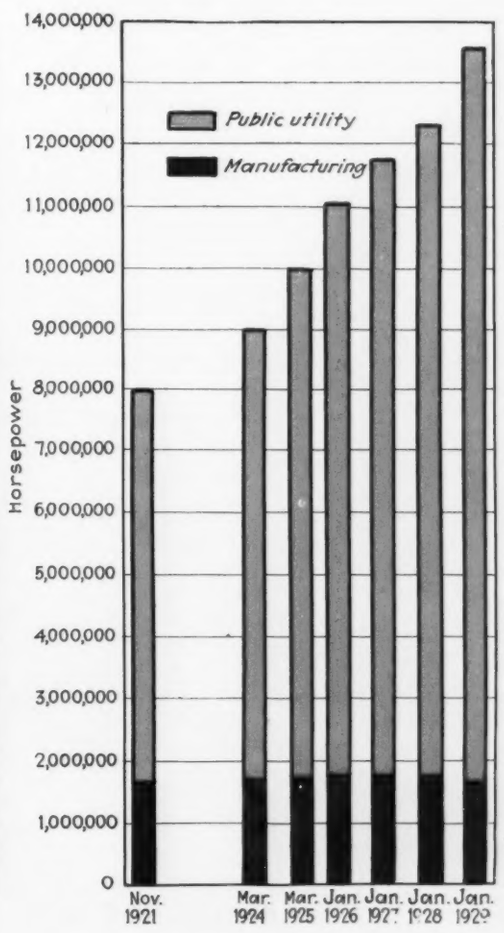
In the whole country the change from the 7,926,958 hp. of 1921 exceeds 5,600,000 hp.

Only about 1,234,000 hp., or less than a fourth of the increase, occurred in the industrial northeastern sector.

Why? A few comparisons will suggest the answer. In New England, the actual horsepower exceeds by 64 per cent the computed amount available 90 per cent of the time. In the East North Central division the excess is 46 per cent. In the Middle Atlantic, although the developed is only 49 per cent of the available, the undeveloped includes several millions in New York on boundary streams where other than engineering and economic considerations govern.

While developments by public utilities have gained, those by manufacturing establishments have decreased not only relatively but absolutely. They fell from 1,726,578 hp. in 1921 to 1,685,194 hp. in 1929.





New England Manufacturing at Record Operations

REPORTS on electrical energy consumption received by the ELECTRICAL WORLD from some 400 large manufacturing plants in New England indicate that operations in these plants during February were of record proportions, exceeding the previous high rate of productive activity recorded in January by 2.4 per cent. The February rate of operations was also 4.4 per cent over February last year, very close to a normal twelve-month increase.

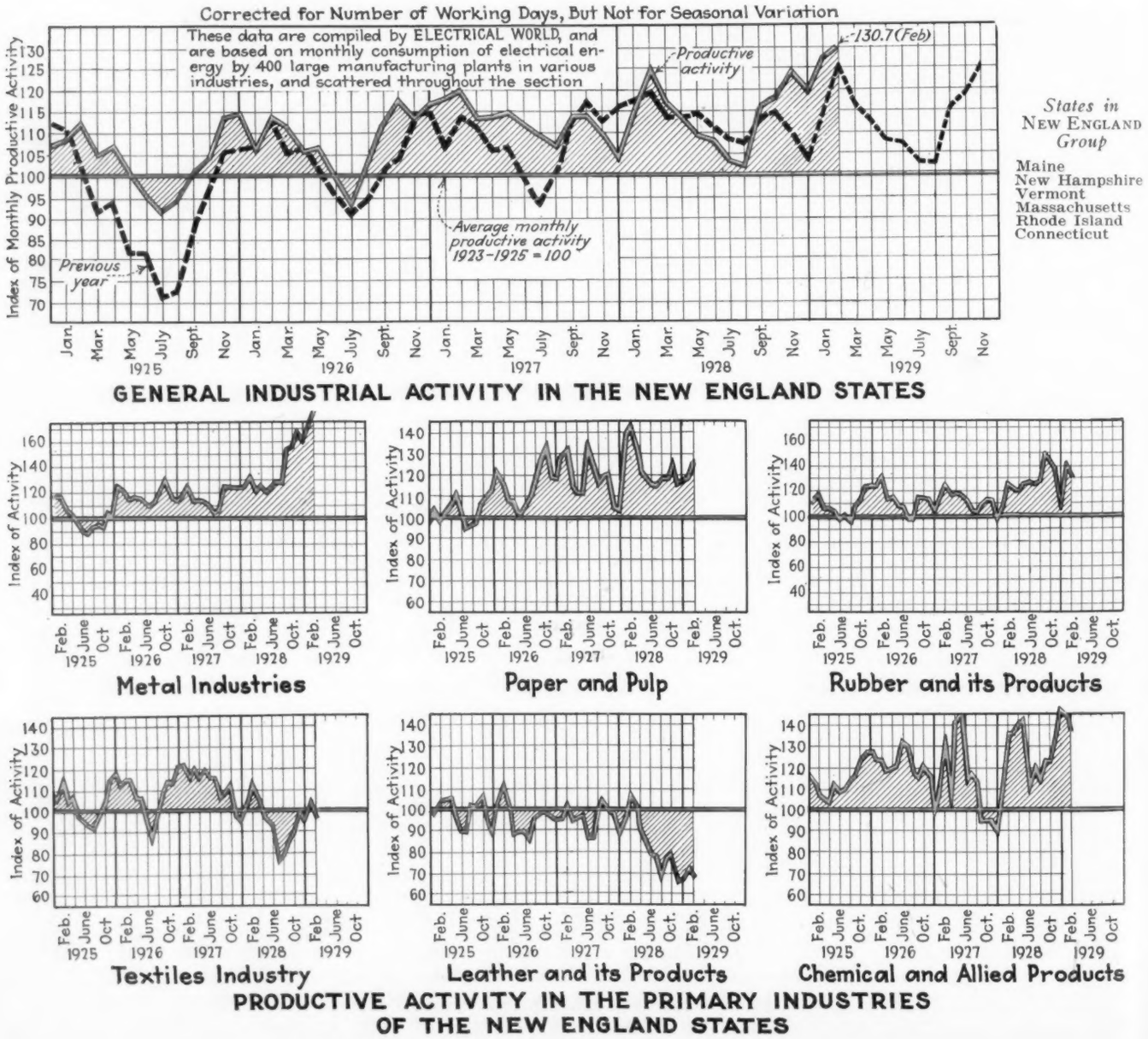
A clear picture of the changing industrial conditions in New England during the past few years is to be found in these index figures on industrial production. Before the war the textile industry was easily the most predominant industrial group of the section. If these plants were in the doldrums the whole industrial outlook of the section was depressed, and the opposite was true when the textile mills were operating at high rates. Today a very different picture is presented, due largely to the influence of the metals industrial group, which has been materially increasing each year since the war.

The textiles industry of New England has been in a decided slump since March last year. Although recent months have witnessed considerable improvement, yet the current operations are around 15 per cent under February last year and 17 per cent under February, 1927.

Indexes of Productive Activity in the New England States
(All Figures Adjusted for Number of Working Days)

	February, 1929	January, 1929	February 1928	Average First Two Months 1929	Average First Two Months 1928
All industry	130.7	127.6	125.2	129.2	120.2
Chemicals and allied products	136.3	139.0	135.8	137.7	127.9
Leather and its products	69.3	71.3	108.4	70.3	102.2
Lumber and its products	78.0	82.0	115.4	80.0	105.8
Metals group	188.0	173.0	133.1	181.0	129.5
Rolling mills and steel plants	222.0	222.2	.....	222.1	.....
Metal-working plants	174.0	153.2	.....	163.6	.....
Paper and pulp	126.8	118.4	143.0	122.6	141.0
Rubber products	130.4	140.6	126.0	135.5	116.5
Textiles	97.0	101.6	114.2	99.3	109.1

ELECTRICAL WORLD *Barometer of Industrial Activity in the New England States*


Corrected for Number of Working Days, But Not for Seasonal Variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
130.7 (Feb)
Average monthly productive activity 1923-1925 = 100
Previous year
Jan. Mar. May July Sept. Nov
1925 1926 1927 1928 1929
States in NEW ENGLAND Group
Maine
New Hampshire
Vermont
Massachusetts
Rhode Island
Connecticut
GENERAL INDUSTRIAL ACTIVITY IN THE NEW ENGLAND STATES
Index of Activity
Feb. June Oct.
Metal Industries
Paper and Pulp
Rubber and its Products
Textiles Industry
Leather and its Products
Chemical and Allied Products
PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NEW ENGLAND STATES